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A Practical Guide for
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Volume I

Disposal Alternatives for the MAPC Region

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COPING WITH THE SOLID WASTE CRISIS:
A PRACTICAL GUIDE FOR LOCAL OFFICIALS AND CITIZENS

VOLUME I

DISPOSAL ALTERNATIVES FOR THE MAPC REGION

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Executive Summary

Finding an environmentally sound and cost-effective long-term solid waste disposal method for communities in the Metropolitan Area Planning Council's region is increasingly difficult. While nearly one-half of the communities are now relying on long-term contracts with resource recovery facilities, the remaining communities are either relying on municipal landfills for disposal or on short-term contracts with private haulers for out-of-town disposal.

Neither municipal landfills, in most instances, nor short-term contracts for out-of-town disposal are adequate disposal methods. Landfills, both municipal and commercial, are either actual or potential sources of water pollution. Further, the per-ton cost of operating state-of-the-art landfills is increasing to the point where it might soon equal or exceed the per-ton cost of disposal at a resource recovery facility. Communities relying on short-term contracts for out-of-town disposal face an uncertain future of rapidly increasing costs and decreasing numbers of contractors willing and able to haul the waste away.

Resource recovery facilities can be expensive, are time-consuming to plan and design, and are not without questions as to their efficiency and air emissions. However, resource recovery will be price-competitive with modern landfills within the next few years and studies are underway to answer questions about air emissions from these facilities.

Therefore, the Metropolitan Area Planning Council recommends that all communities which are not now using or under contract to use resource recovery facilities begin making plans to do so. During the initial stages of planning for a resource recovery facility, communities will not need to choose a vendor or technology. By the time the communities are organized to support a regional effort and are ready to select a vendor and a technology, studies on air emissions should be completed. At that time, the MAPC and communities will be able to determine whether air pollutants, such as dioxins, are present and, if they are, under what conditions they can be eliminated or controlled.

The MAPC also recommends that communities implement source reduction and recycling programs to cut costs and conserve landfill space.

This three-volume study is designed to assist local decisionmakers in choosing a long-term solid waste disposal solution for their community. Information in Volume I lists current practices throughout the region, then covers landfilling, resource recovery, volume reduction and recycling, transportation considerations, and, briefly, the state plan for solid waste disposal.

Volume II focuses on the 18 communities in the Southwest subregion. Since this subregion is the least served by existing disposal facilities, the Council has chosen to develop a step-by-step plan to aid the communities in choosing and implementing a regional disposal facility.

Volume III contains information from MAPC's solid waste data base, organized by community. Decisionmakers may find it useful to know how much waste is generated by nearby communities, which ones have successful recycling programs, how much disposal costs, and so on.

The MAPC hopes that information provided in these three volumes will help steer local decisionmakers away from continuing reliance on local landfills and short-term contracts with commercial haulers. Instead, the MAPC would like to see most, perhaps all, communities in the region relying on long-term contracts with cost-effective and environmentally sound disposal facilities.

THIS EXECUTIVE SUMMARY is included in identical form in each of the three volumes, since they may often be read separately. A broad overview of all three volumes will be useful for the reader who sees only one of the volumes.

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1. Summary of Regional Practices and Problems

Introduction to Current Practices

Each year the 101 cities and towns in the MAPC region generate approximately 1,847,327 tons of municipal solid waste. Currently 1,091,117 tons per year or 59% of this waste is landfilled, in either a commercial or municipal landfill. Some 695,630 tons (38%) are processed in resource recovery facilities, and the remaining 60,580 tons (3%) are burned in Framingham's incinerator.

Statewide, 84% of the waste is landfilled and 11% is processed by resource recovery plants. The primary reason that the MAPC communities rely more heavily on resource recovery than the state as a whole is the urbanized nature of the region. The mounting pressures of population, pollution, land costs, and pollution control costs have already forced many MAPC communities to find an alternative to landfill disposal.

This study is designed to assist local decisionmakers who are faced with a multitude of complex, interrelated issues on solid waste disposal alternatives. These issues are financial, environmental, legal, contractual, technological, regulatory, siting, and transportation-related. To help local officials and residents make decisions on these issues, this study provides information on current disposal practices, available disposal alternatives, the state plan, and related issues such as transportation costs.

For the purposes of this study, municipal solid waste is defined as that waste generated by households (residential waste). Commercial waste, that produced by commercial establishments and institutions, is not included in this study, except where a community now handles it along with residential waste. Accurate estimates of the amount of commercial waste generated throughout the region are unavailable, either from the companies generating the waste, state agencies, individual communities, or private haulers. Special wastes--demolition debris, water and wastewater treatment sludges, household hazardous wastes, incinerator ash, and tree stumps--are all addressed separately because they require special disposal methods.

The composition of municipal solid waste is shown in Table 1-1.

Table 1-1

Municipal Solid Waste Composition

Component	Percent	
Paper	32.8	
Newspaper		6.0
Corrugated		9.0
Office paper		4.0
Other		14.1
Glass	9.9	
Ferrous metals	8.2	
Nonferrous metals	1.0	
Food waste	16.6	
Yard waste	18.5	
Other	12.8	
Total	100.0	

Source: Decision-Makers Guide in Solid Waste Management U.S. EPA, 1976.

Currently, there are a total of 38 active landfills serving the MAPC region, 7 are commercial (764,015 tons per year or 68%) and 31 are municipal (352,497 tons or 32%). Many of these landfills are reaching capacity; 4 commercial and 20 municipal landfills will close by 1990. Five municipal landfills are applying for permission to expand, but handle only 4% of the waste now being landfilled in the MAPC region.

As described in the Department of Environmental Management's report on active landfills, the lack of adequate disposal facilities is reaching crisis proportions. MAPC communities have been searching for alternative disposal methods for several years. Some communities and groups of communities have found a long-term solution in one of the three operating resource recovery facilities serving the MAPC region: RESCO in Saugus; Refuse Fuels, Inc. in Haverhill; and NESWC in North Andover. A fourth facility, SEMASS, is to be built in Rochester, but will not begin commercial operation for three to four years at the earliest.

However, as recognized in the MAPC Goals and Policies Statement, the region needs a system of waste management facilities, including transfer and compaction stations, resource recovery plants, composting and other means of volume reduction, with landfills used as the last resort for backup and residue disposal. These disposal facilities must be environmentally sound, cost-effective, and available on a long-term basis.

The MAPC recommends that all communities not yet using or under contract to use a long-term disposal method begin planning immediately for source reduction, recycling, a short-term disposal alternative, and a long-term disposal solution. Source reduction methods, such as local composting and reuse of yard waste, can have a significant impact on the total waste stream requiring disposal. Also, asking residents through a public education effort to consider the solid waste disposal ramifications of products they buy (especially those items made to be disposable) can result in a drop in the waste stream. Source reduction, when combined with recycling of paper, glass, ferrous and nonferrous metals, and white goods, can both decrease the amount of waste to be disposed and return useful materials to the product manufacturing system. This decrease in the amount of waste will extend the life of a landfill or result in fewer tons hauled out of town by a commercial hauler at exorbitant rates.

A short-term disposal alternative is defined as one which will be available to a community for the next five years (i.e., until 1990-92). A short-term method may be necessary for disposal while communities are procuring a long-term facility. While some communities have municipal landfills which will last until a long-term facility begins commercial operation (optimistically estimated at a minimum of five years from the time planning begins), most cities and towns will need an interim facility. This interim facility should phase into the long-term disposal solution chosen by communities.

The long-term solution should be available for a minimum of 20 years and should be both environmentally sound and cost-effective. Although there are many questions to be answered before a particular technology or facility can be chosen, the MAPC recommends that communities consider resource recovery as their long-term disposal solution. Other than landfilling, one of the resource recovery technologies is the only long-term disposal method. Since landfilling, except as a backup facility, is not a preferred technology, MAPC recommends that communities investigate resource recovery. While communities are organizing into a regional group and studying all the necessary information, MAPC hopes that answers to questions such as dioxin emissions will be forthcoming from state and federal environmental agencies.

To facilitate planning for solid waste disposal, the MAPC region has been divided into six subregions: Inside 128, North Shore, Minuteman, MetroWest, Southwest, and South Shore (see Figure 1-1 and Table 1-2). Subregional breakdowns of waste generated and amount landfilled or sent to a resource recovery facility are given in Table 1-3.

The remainder of this section of the study gives the current status of disposal practices in each of the six subregions, along with MAPC's recommendations for that subregion. Subsequent sections in Volume I contain generic information on landfills, resource recovery facilities, recycling and other volume reduction methods, transportation considerations, and the state plan.

Volume II of the study will present one subregion, the Southwest, in detail and Volume III will give data on each of the 101 MAPC communities.

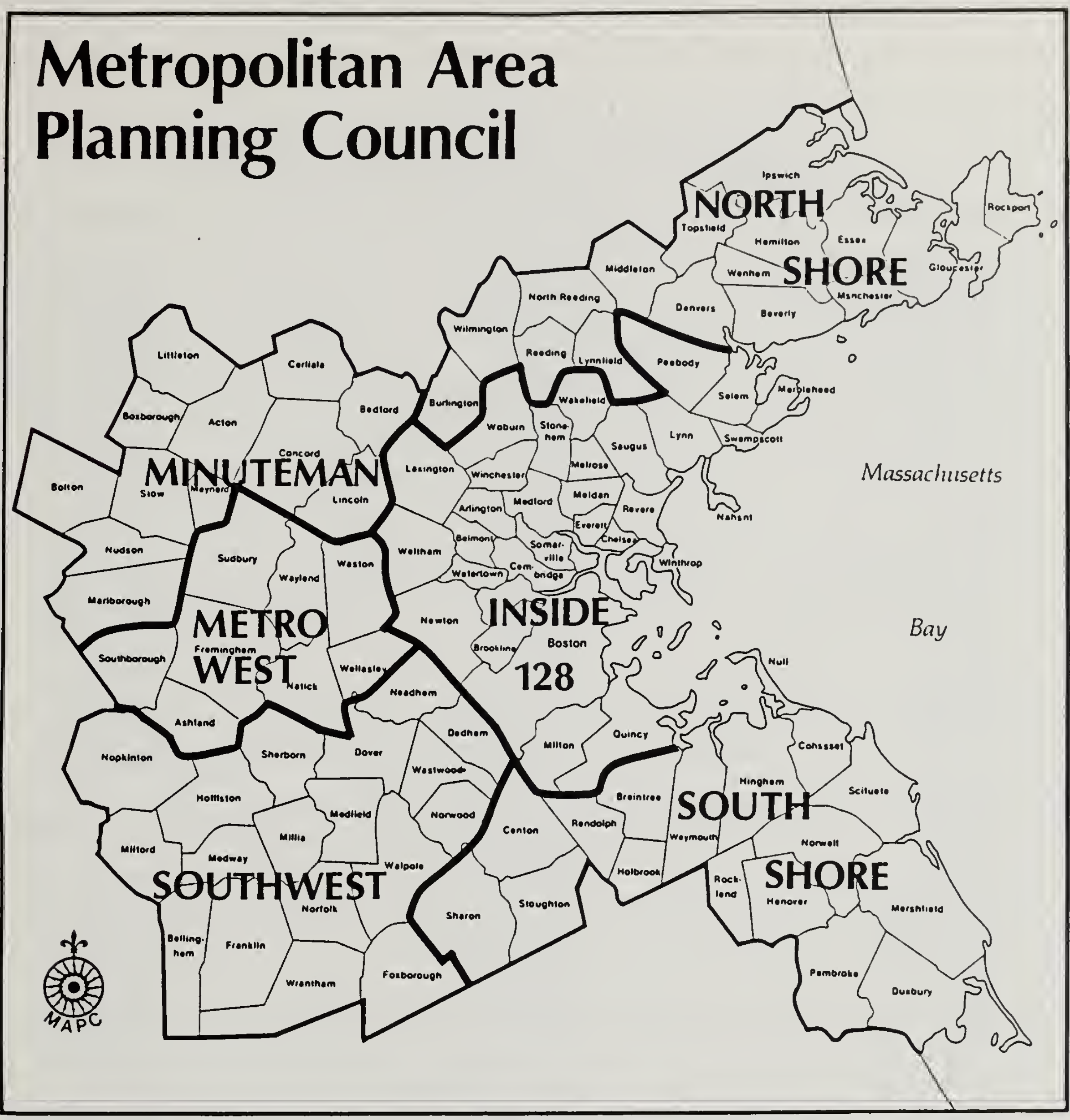


FIGURE 1-1
THE SIX MAPC SUBREGIONS

Table 1-2

Communities In Each of the Six Subregions

1. Inside 128 (30)

Boston
Arlington
Belmont
Brookline
Cambridge
Chelsea
Everett
Lexington
Lynn
Malden
Marblehead
Medford
Melrose
Milton
Nahant
Newton
Peabody
Quincy
Revere
Salem
Saugus
Somerville
Stoneham
Swampscott
Wakefield
Waltham
Watertown
Winchester
Winthrop
Woburn

2. North Shore (16)

Beverly
Burlington
Danvers
Essex
Gloucester
Hamilton
Ipswich
Lynnfield
Manchester
Middleton
North Reading
Reading
Rockport
Topsfield
Wenham
Wilmington

3. Minuteman (12)

Acton
Bedford
Bolton
Boxborough
Carlisle
Concord
Hudson
Lincoln
Littleton
Marlborough
Maynard
Stow

4. MetroWest (8)

Ashland
Framingham
Natick
Southborough
Sudbury
Wayland
Wellesley
Weston

5. Southwest (18)

Bellingham
Dedham
Dover
Foxborough
Franklin
Holliston
Hopkinton
Medfield
Medway
Milford
Millis
Needham
Norfolk
Norwood
Sherborn
Walpole
Westwood
Wrentham

6. South Shore (17)

Braintree
Canton
Cohasset
Duxbury
Hanover
Hingham
Holbrook
Hull
Marshfield
Norwell
Pembroke
Randolph
Rockland
Scituate
Sharon
Stoughton
Weymouth

Table 1-3

Solid Waste Generated in the MAPC Region

(Tons Per Year)

Subregion	Subtotal	Landfilled	Resource Recovery
Inside 128	1,146,913	602,204 (53%)	544,709 (47%)
North Shore	165,305	64,933 (39%)	100,372 (61%)
Minuteman	85,054	34,505 (40%)	50,549 (60%)
MetroWest	137,141	76,561 (56%)	*
Southwest	138,423	138,423 (100%)	0
South Shore	174,491	174,491 (100%)	0
Total for region	1,847,327	1,091,117 (59%)	695,630 (38%)

* Framingham generates the remaining 44% (60,580 tons) of waste in this subregion, and burns it in the city's incinerator.

Source: MAPC calculations based on information from the communities and the Bureau of Solid Waste Disposal.

Subregion 1. Inside 128

Table 1-4. Inside 128 Subregion

	No.	Tons/Year
Communities:	30	1,146,913
Communities with municipal landfills:	3	89,341
Communities using commercial landfills:	6*	512,863
Communities using resource recovery:	22*	544,709
Communities recycling:	9	NA

Communities relying on short-term disposal:

Boston	Milton	Salem
Brookline	Newton	Woburn
Cambridge	Quincy	

*Boston is counted twice because some of its waste is landfilled and some sent to RESCO.

The 30 communities in this subregion, including the City of Boston, still landfill over one-half of their solid waste (53%). However, these statistics will soon change as Boston has now chosen a long-term disposal method (a combination of three resource recovery facilities). Some 22 communities (including two districts in Boston) are already relying on resource recovery; 16 have contracted with the RESCO facility in Saugus and 6 with NESWC in North Andover. The City of Somerville is in advanced negotiations with vendors of another resource recovery technology.

Recommendations for the Inside 128 subregion.

- Since all three remaining municipal landfills (Milton, Quincy, and Woburn) will be closed well before the end of the decade, and since many of the commercial landfills serving other communities in the subregion (Boston, Brookline, Cambridge, Newton, Salem, and Somerville) will also close, these communities must address the fact that continued landfilling is only a very short-term disposal method.

- Fortunately, there are three resource recovery facilities now available (others are planned) and those communities in the northern half of the subregion should give serious consideration to joining one.

- Milton and Quincy may have short-term problems bridging the gap between closure of their landfills (1985 and 1987, respectively) and availability of long-term disposal options in the southern half of the region. These two communities should be studying the alternatives now.

Subregion 2. The North Shore

Table 1-5. The North Shore Subregion

	No.	Tons/Year
Communities:	16	165,305
Communities with municipal landfills:	3	41,360
Communities using commercial landfills:	1	23,573
Communities using resource recovery:	12	100,372
Communities recycling:	NA	NA
Communities relying on short-term disposal:	3	67,111
Gloucester Lynnfield Danvers		

The North Shore subregion includes the oldest resource recovery facility in the Commonwealth: RESCO in Saugus. Construction of this facility was spurred on by several communities whose landfills were reaching capacity in the early 1970s. RESCO's existence has made it much simpler for communities in this subregion to select a long-term disposal option.

Four communities (25%) are relying on landfills. Two of them, Middleton and Topsfield, have municipal landfills with capacity for the town's waste well into the 1990s (1994 and 1999, respectively). The Middleton landfill has not yet been assessed for water pollution; evidence has been found, but not documented at the Topsfield landfill.

Recommendations for the North Shore Subregion:

- Gloucester and Lynnfield need to choose a long-term disposal option. Closure of Gloucester's landfill is imminent, while Lynnfield is now relying on a short-term contract with a commercial hauler.

- Middleton and Topsfield are not yet faced with a disposal crisis since their municipal landfills have years of capacity remaining. However, the potential for pollution from these landfills, the increasing costs of landfill disposal, and the possibility of being "shut out" of a nearby resource recovery facility (when such facilities reach capacity) --for these reasons, Middleton and Topsfield may want to choose another disposal method before their landfills reach capacity.

Subregion 3. Minuteman

Table 1-6. The Minuteman Subregion

	No.	Tons/Year
Communities:	12	85,054
Communities with municipal landfills:	4	25,085
Communities using commercial landfills:	2	9,420
Communities using resource recovery:	6	50,549
Communities recycling:	3	NA

Communities relying on short-term disposal:

Bolton
Concord
Hudson
Littleton
Maynard
Stow

While 60% of this subregion's waste is now processed by a resource recovery facility, half of the communities are still relying on a short-term disposal method: either municipal or commercial landfills. Only Concord's municipal landfill has the capacity to accept waste beyond 1990.

Five of the communities in this subregion have contracts with the NESWC facility in North Andover, which has just begun commercial operation. The sixth community is using RESCO in Saugus.

Recommendations for the Minuteman Subregion:

- Hudson and Littleton are faced with imminent closure of their municipal landfills. These two communities should make a decision on long-term disposal alternatives as soon as possible. Bolton has only slightly more time to consider available long-term alternatives.

- Concord is not yet faced with a disposal crisis because the municipal landfill has the capacity to serve the town until 1995. However, the landfill has a documented pollution problem with some remedial leachate control measures. So, the town may want to consider another long-term disposal option and close the landfill before it reaches capacity.

- Maynard and Stow are presently relying on commercial landfill disposal. This is not a long-term disposal option and can be counted on only for the length of the contract the community has with the commercial hauler or landfill. Each of these communities should be investigating long-term alternatives, with the intent to choose one as soon as possible.

Subregion 4. MetroWest

Table 1-7. The MetroWest Subregion

	No.	Tons/Year
Communities:	8	137,141
Communities with municipal landfills:	4	50,284
Communities using commercial landfills:	3	26,277
Communities using resource recovery:	0*	0
Communities recycling:	4	NA

Communities relying on short-term disposal:

Ashland	Wellesley
Southborough	Weston
Wayland	

* Framingham's incinerator is not added in here, because it is basically a volume reduction disposal facility; it does not include recovery of energy or materials.

The MetroWest subregion is not currently served by a resource recovery facility. Several communities, Wayland, Needham, Wellesley, Sudbury, and Natick, are considering a regional solution involving the Framingham incinerator. All communities in the subregion, except Framingham, presently rely on landfills.

An April 1985 MAPC study of solid waste disposal in the MetroWest region concluded that:

> The disposal of solid waste has become a major concern that is too difficult for communities to deal with on an individual basis. Regional solutions are gaining ground, while public education programs, making people more aware of the crisis in solid waste disposal, are on the increase.
>
> Statistical projections, based on current data, show that by 1995, seven of the eight MetroWest communities now using landfills will have to dispose of their refuse outside the MetroWest region.

Recommendations for the MetroWest subregion:

- Each of the eight communities would best serve its residents by investigating all the available long-term disposal options, including those in the Minuteman and Southwest subregions.

Subregion 5. The Southwest

Table 1-8. The Southwest Subregion

	No.	Tons/Year
Communities:	18	138,423
Communities with municipal landfills:	8	60,254
Communities using commercial landfills:	10	78,169
Communities using resource recovery:	0	0
Communities recycling:	11	NA

Communities relying on short-term disposal:

Bellingham
Dedham
Dover
Franklin
Holliston
Hopkinton
Medfield
Medway
Milford
Millis
Norwood
Sherborn
Walpole
Westwood
Wrentham

More than one-half of the towns in this subregion as well as more than one-half of the total tonnage needing disposal in this subregion is now handled outside the community that produces it. After 1990, 16 communities (127,720 tons) will not be able to handle disposal on an individual basis; over 90% of the waste will have to be sent to a commercial landfill or a resource recovery facility.

However, there are no existing resource recovery facilities in the subregion. A planned facility, SEMASS, to be located in Rochester, Massachusetts, will not begin commercial operation before 1988, at the earliest. Because of the distance from communities in this subregion to Rochester, the SEMASS facility may not be an appropriate long-term alternative for most of the communities. Also, the SEMASS facility is already fully subscribed.

Recommendation for the Southwest Subregion:

- Since all 18 communities will need a long-term disposal option, these communities would be best served by coordinating their efforts towards a regional facility.

The Southwest subregion is presented in more detail in Volume II of this study.

Subregion 6. The South Shore

Table 1-9. The South Shore Subregion

	No.	Tons/Year
Communities:	17	174,491
Communities with municipal landfills:	9	86,173
Communities using commercial landfills:	8	88,318
Communities using resource recovery:	0	0
Communities recycling:	8	NA

Communities relying on short-term disposal:

- Braintree
- Cohasset
- Duxbury
- Hanover
- Holbrook
- Hull
- Pembroke
- Randolph
- Weymouth

All of the communities in this subregion are currently landfilling waste. Canton, Sharon, Norwell and Stoughton have signed contracts with SEMASS, a planned resource recovery facility.

Recommendations for the South Shore subregion:

- Since only four communities in this subregion (Hingham, Marshfield, Rockland, Scituate) have landfills with the capacity to accept waste after 1990, all the communities in this subregion should be investigating long-term disposal options.

2. Landfills

2.1 Introduction

The most popular method of solid waste disposal over the centuries has been the landfill. Landfilling in the past provided a relatively inexpensive and simple way for a community to dispose of its refuse. Early landfills--more accurately and until recently called dumps--simply burned the refuse on-site with no environmental controls. Moreover, it was not uncommon to find a dump or landfill located in a wetland or gravel pit, providing easy entry for contaminants into surface and groundwaters. With no regulations for incoming wastes, virtually anything could be and was landfilled, including industrial hazardous wastes. These unregulated landfills pose a threat even today.

Fortunately, a new concern for the environment put an end to the practice of open dumping. Amendments to the Federal Clean Air Act of 1967 declared that burning wastes at open dumps was illegal. In 1971, the Commonwealth passed regulations concerning the siting, design, and operation of landfills. However, it was not until the passage of the Massachusetts Hazardous Waste Act of 1979 that landfilling of hazardous wastes was officially prohibited. However, small quantities of hazardous waste, often from households, continue to wind up in landfills. Household hazardous waste includes: pesticides, herbicides, solvents, cleaners, fuel, paints, waste oil, nail polish remover, and many other substances commonly found in residences.

In a 1985 report published by the Massachusetts Public Interest Research Group (PIRG), of the 21 officially designated hazardous waste sites in Massachusetts, 6 are landfills. For example, samples from private wells surrounding the SCA landfill in Amesbury were tested and indicated the presence of several volatile organic chemicals (including TCE, an industrial hazardous waste). Testing from wells around the Charles George landfill in Tyngsboro revealed the presence of 40 chemical compounds. With the heavy dependence on groundwater for drinking water supplies in Massachusetts, the threat of contamination and loss of water supply is a very serious concern.

According to a DEM report published in May 1985 (with information updated by MAPC to September 1985), there are 31 active municipal and 7 active commercial landfills serving the MAPC region. Of these, two have documented groundwater and/or surface water pollution problems. Some evidence of contamination is present in 18.

By 1990, 21 of these municipal landfills are scheduled to be closed; by 1995, 28 of them (88%) should be closed. Six of the seven commercial landfills have expansion plans, but four will close by 1990, if approval of expansion plans is not forthcoming. These seven commercial landfills account for 764,105 tons per year or 68% of the total waste landfilled in the region. As more and more of the municipal landfills close, these commercial ones will be asked to provide disposal services. Commercial operators may not be willing to accept additional tonnage and, if they do, the costs will be very high. Further, the commercial landfills are not distributed evenly throughout the region, meaning that some communities may also face prohibitive transportation costs to truck their waste to a distant regional landfill.

DEQE's new landfill regulations, due to be completed by early 1986, will require stricter controls of landfill leachate, gas, runoff, and closure, while still allowing for design flexibility. The additional control measures will mean higher per-ton costs for landfill disposal in the future.

Before deciding to expand or improve an existing landfill, the potential environmental impacts of continued landfilling must be addressed. If not regulated closely, landfills may contaminate ground and surface waters, destroy wildlife habitat, and increase flooding. In addition, the accumulation of methane gas in landfills may cause explosions at the site and at off-site locations.

A fully compliant, model landfill, as contrasted with a noncompliant landfill or dump, is an expensive and difficult proposition. The ideal facility would be underlaid with an impermeable or low-permeability liner of clay or ultra heavy-gauge vinyl. Newly disposed refuse would be covered with soil daily. Surface runoff and/or surficial leachate intrusions would be channelled, collected, or otherwise diverted, and safely recycled or removed from the site.

There are also more expensive, seldom-used approaches that work beneath the surface to control leachate. These techniques include: a) boring wells and installing collection pipes to alter the shape and velocity of the water table, which in turn can slow the rate of leachate movement; b) pumping out already-contaminated groundwater by means of new wells; and c) a great variety of related techniques, all of which can be custom-designed for a particular site.

Leachate control systems are only part of the total landfill design picture. Dust, odors, litter, rodents, insects, vehicular access, overall operational safety, fire protection, visual screening, special waste handling, and other considerations must all be addressed. It is also important to understand that some improvements, particularly the installation of the subsurface liners, are not a practical option at existing landfills where filling has already begun. More costly leachate collection and diversion systems must be considered for existing landfills. In addition, a pollution monitoring program is nearly always necessary.

All of the preceding items represent major capital expenditures. The cost of modifying an existing landfill to meet DEQE's new regulations recently came into the public spotlight, due to a disagreement within the State Administration over whether the Commonwealth is obligated to pay for mandated improvements. Newly proposed state policies would compel the Commonwealth to bear a portion of the costs. The situation is not helped by the fact that the regulations under Chapter 111 of the General Laws are vague as to the scope and extent of mandated requirements. New regulations have been proposed which do not entirely resolve this legal problem.

In the MAPC region, there are 38 active landfills (see Table 1-10). Of this total, 31 are municipally owned and operated, with the remaining 7 either commercially owned and operated or a commercial/municipal joint operation. DEQE has identified 20 landfills that constitute a potential or actual threat to water quality. Of these, only eight have now installed pollution monitoring equipment. Only five landfills to date have installed liners or leachate collection systems. At least five MAPC communities are presently considering expansion of their municipal landfills.

In terms of environmental protection, only one municipal landfill begins to approach model status: Peabody's. Other landfills do meet basic regulatory requirements, but in Peabody, the State has recently made major capital improvements. In exchange for these improvements, the Peabody landfill is accepting the residual ash from the Northeast Solid Waste plant operated by RESCO in North Andover. Three communities are closing their municipal landfills as they begin sending waste to NESWC: Acton, Boxborough, and Lincoln.

Some of the environmental problems of landfills are explained in greater detail in the following subsections. Due to these difficulties, it is extremely hard to expand any landfill successfully, and it is nearly impossible to site a new one within a metropolitan area.

Table 1-10

Active Landfills Serving the MAPC Region

Municipal Landfills	Closure Date	Tons Per Year	Water Pollution	Considering Expansion
1. Bellingham	1988	10,612	Not assessed	
2. Bolton	1990	4,600	Not assessed	
3. Cohasset	1989	4,000	Evidence	
4. Concord	1995	8,208	Evidence	
5. Dover	1987	2,373	Not assessed	
6. Foxborough	1993	8,000	Not assessed	
7. Gloucester	1985	36,400		
8. Hingham	1993	12,500	Evidence	
9. Holbrook	1986	7,958	Documented	
10. Hudson	1985	8,404	Not assessed	
11. Hull	1985	4,907	Evidence	
12. Littleton	1986	3,537	Not assessed	
13. Marshfield	1998	13,500	Not assessed	
14. Medfield	1987	5,164	Evidence	
15. Middleton	1994	2,110	Not assessed	
16. Millis	1987	9,360	Not assessed	
17. Milton	1985	21,000	Evidence	
18. Natick	1992	17,888	Evidence	Yes
19. Needham	1990	20,000	Evidence	
20. Norfolk	1995	2,500	Evidence	
21. Pembroke	1985	5,500	Not assessed	Yes
22. Quincy	1987	42,000	Evidence	Yes
23. Randolph	1986	14,218	Evidence	
24. Rockland	1993	7,885	Not assessed	
25. Scituate	2000	20,000	Not assessed	
26. Sherborn	1986	2,080	Evidence	
27. Sudbury	2000	10,800	Evidence	Yes
28. Topsfield	1999	2,832	Evidence	
29. Wayland	1987	10,000	Documented	Yes
30. Weston	1987	11,596	Evidence	
31. Woburn	1986	26,500	Evidence	

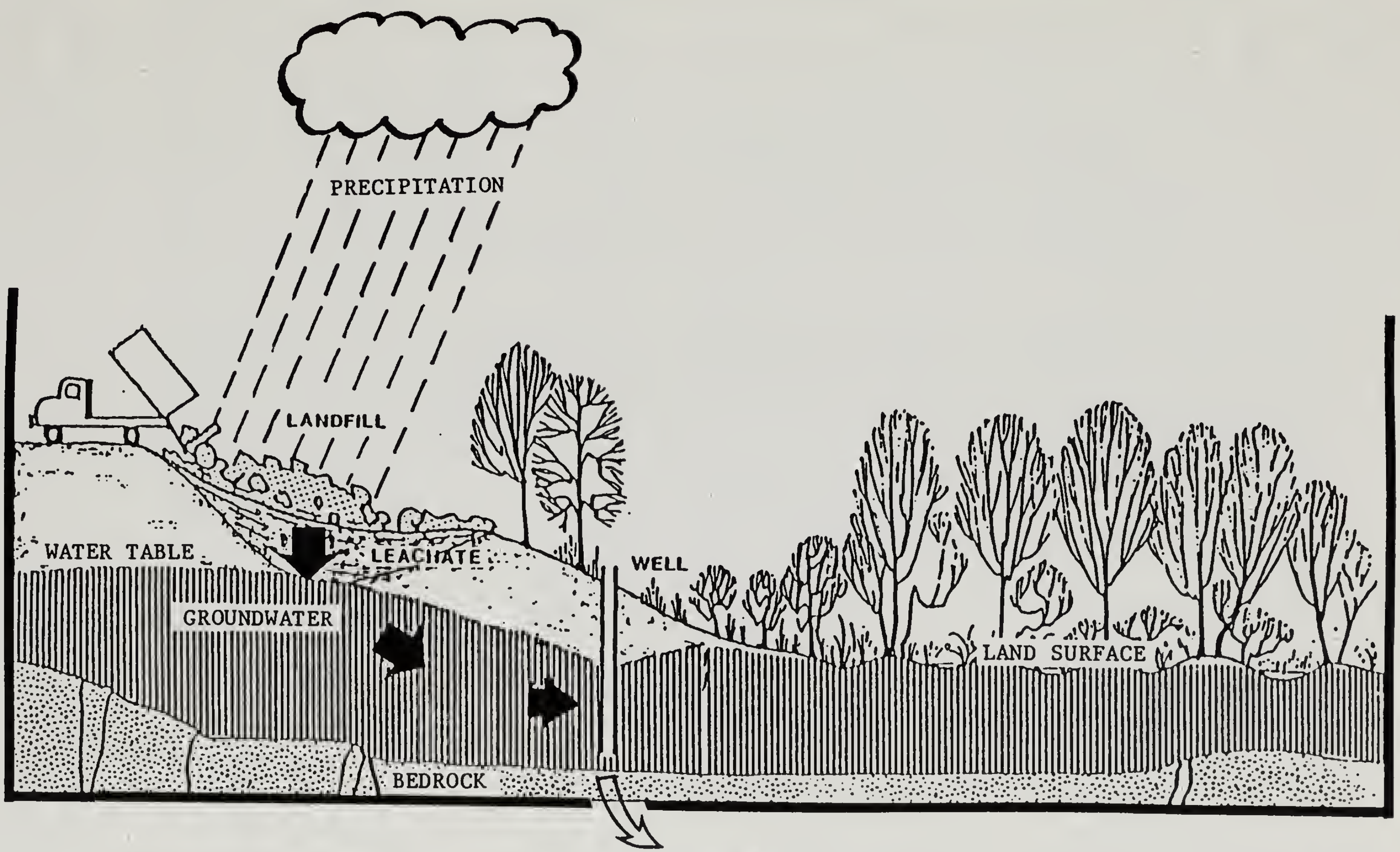
Commercial Landfills	Closure Date	Expansion Date	Water Pollution
1. Acushnet Prop./Acushnet	1987	1989	Evidence
2. Attleboro LF/Attleboro	1989	1999	Not assessed
3. E.L. Harvey/Westboro	1987	2007	Not assessed
4. J. Melone/Hudson	1988		Not assessed
5. Laidlaw Waste/Plainville	1999	2001-3	Not assessed
6. City of Peabody/Peabody			Evidence
7. Refuse Fuels/Haverhill	2010	2020	Not assessed

2.2 Groundwater and Surface Water Contamination

Groundwater contamination by landfill leachate may produce devastating and long-lasting effects. Leachate is created when precipitation in the form of rain or snow falls on the landfill and trickles, or percolates, through the cover material to the solid waste (see Figure 1-2). As the water passes through, it dissolves the various materials it comes into contact with, such as metals, salts, organic compounds, and inorganic chemicals, and forms leachate. The leachate continues to move vertically downward until it reaches the water table. Depending on the thickness and type of refuse and soil encountered, the amount of precipitation, and the depth to groundwater, the time it takes the leachate to reach the water table varies.

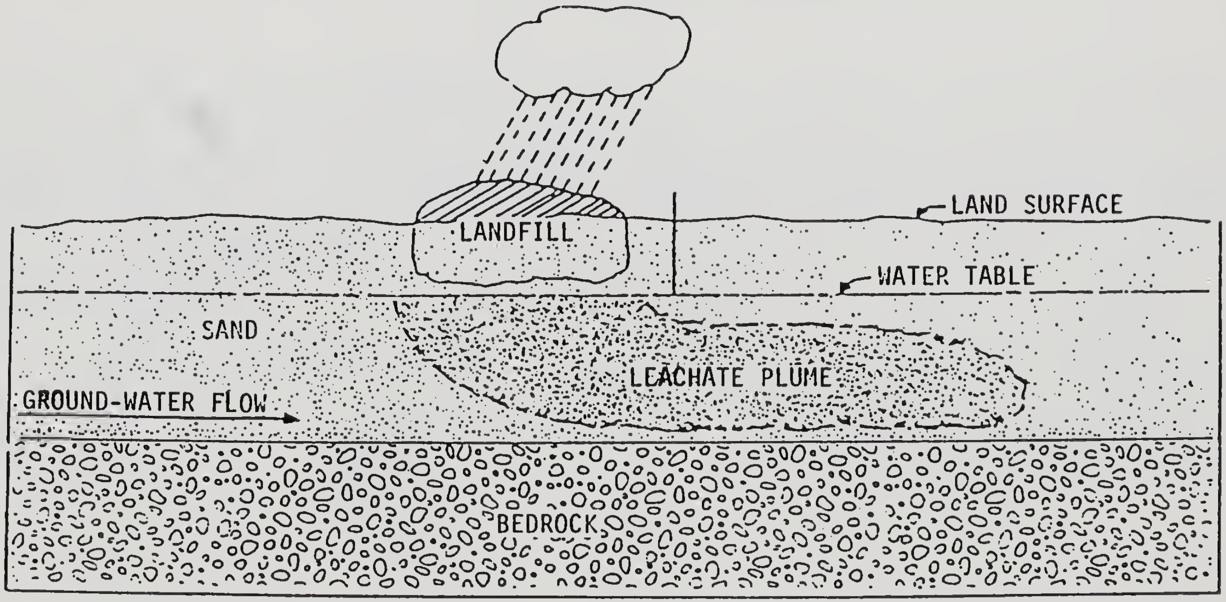
Once the leachate makes its way to the groundwater, it is carried along with the groundwater flow. Groundwaters generally move quite slowly, resulting in the relatively slow dispersal of the leachate. The contaminating leachate travels in a plume (see Figure 1-3). It may take decades before the plume is detected in which case it might be too late to save a drinking water supply. Reclaiming polluted groundwater is much more difficult, time-consuming, and expensive than reclaiming contaminated surface water.

Contamination of surface water may occur by leachate flowing in the groundwater or by contaminated runoff directly from the landfill. As groundwater emerges into surface waters, such as streams, lakes, or rivers, leachate plumes discharge into these water bodies. Precipitation falling on inadequately covered landfills can be contaminated and drain into a stream or lake. Like groundwater, surface waters may also provide water for human consumption. Thus, contamination of these water bodies may eliminate another source of drinking water. Furthermore, fish, plant, and other wildlife may be destroyed.



IF GROUNDWATER IS CONTAMINATED BY LEACHATE FROM LANDFILL, THEN WELL WATER IS ALSO CONTAMINATED

Figure 1-2. Groundwater Contamination by Leachate from Landfill



Landfill on a Single Aquifer With a Deep Water Table - Leachate percolates downward from the landfill to the underlying aquifer and then moves downgradient as a bulb plume in the direction of ground-water flow. The mass of leachate may sink to the bottom of an aquifer if of a heavier specific gravity. A monitoring well installed at water table depth will not intercept the leachate plume in this case.

Figure 1-3. A Leachate Plume.

2.3 Gas Accumulation

Municipal landfills contain a variety of wastes, including food, paper, metals, glass, and plastics. Organic wastes, such as food scraps, begin to decompose in the landfill; as part of this natural decomposition process, gas products are formed. Landfill gas consists of methane and carbon dioxide with trace amounts of other substances. Methane is by far the most hazardous component because it is combustible. When methane reaches an accumulation between 5 and 15 percent and mixes with air, it can explode.

On-site landfill explosions are dangerous in themselves; however, the physical characteristics of the gas enable it to migrate laterally through soil. The gases may then collect in underground structures, such as basements, and may produce an explosion some distance away from a landfill. Because methane gas is odorless and colorless, detection is especially difficult and requires special equipment.

In selected cases, landfills can be "mined" to collect the gas. After processing, the methane fraction can be used just like natural gas.

2.4 Landfill Closure

Regardless of the design and control measures included, landfills have finite lives; space requirements set limits on the amount of refuse which can be disposed. Landfill closure entails compaction of the landfill to a designated level, application of a final cover material, which is relatively impermeable; control and/or monitoring of landfill leachate; and control and monitoring of landfill gas.

The final cover or "cap" is critical to the abatement of ground and surface water pollution. An improperly compacted landfill may develop depressions where ponding and, eventually, percolation will occur. Generally, capping procedures require a multilayered system to be effective. For example, a landfill cap may consist of compacted soil, followed by a layer of clay or other impermeable material, followed by sand and gravel, followed by a layer of topsoil. The topsoil provides a good anchor for vegetation, which is necessary to reduce soil erosion. The sand and gravel layer provides a drainage outlet for precipitation above the impermeable layer (see Figure 1-4).

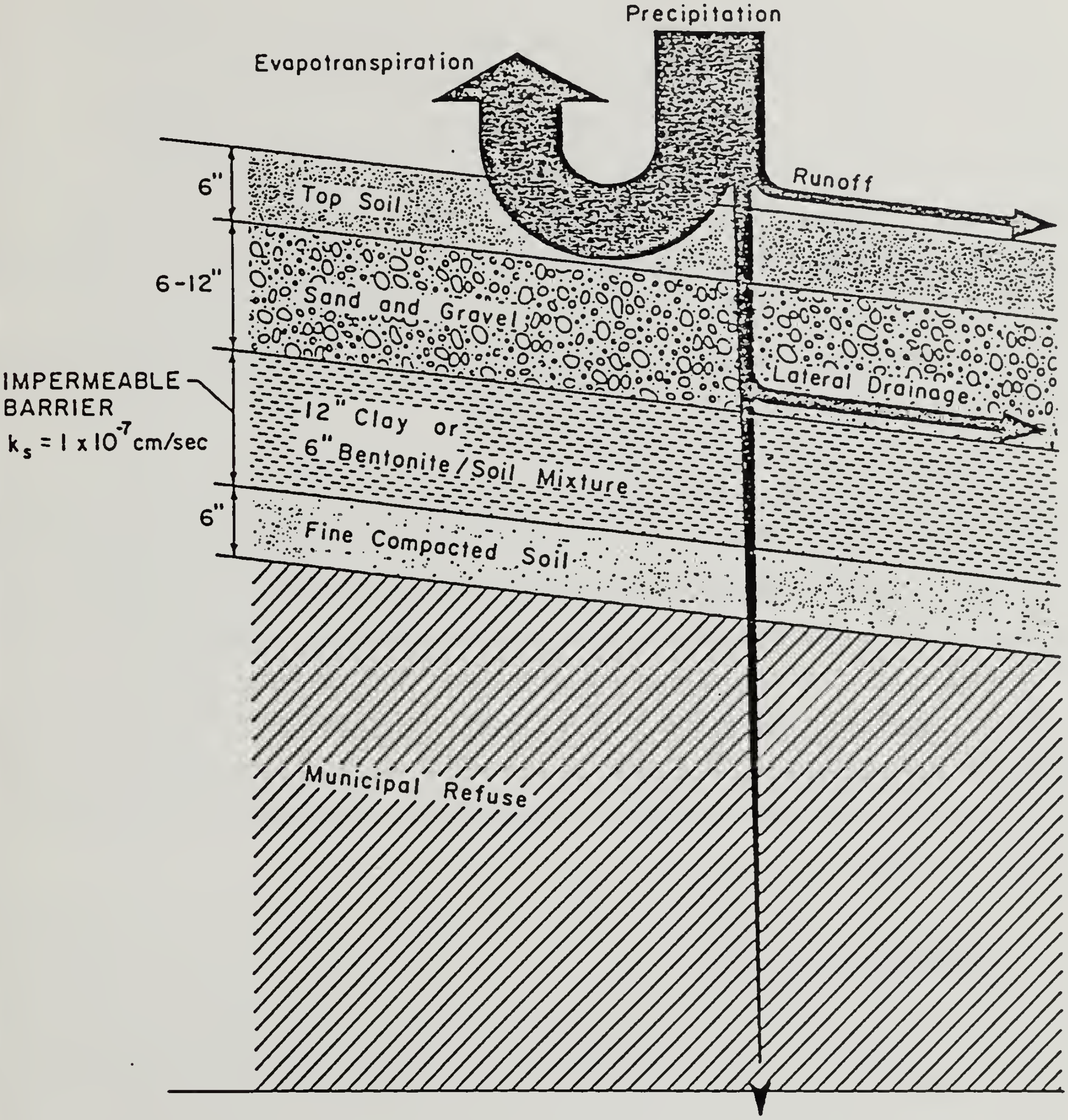
2.5 Landfill Liners and Caps

In order to prevent leachate from contaminating ground and surface water, an impermeable material is required to construct landfill liners and caps. As mentioned above, capping a landfill is essential to prevent the intrusion of precipitation. Likewise, in developing a new landfill, an impermeable liner is necessary to contain leachate and keep it from entering groundwater.

There are several materials which can be used for liners and caps. Clay, hydraulic asphalt, soil cement, bentonite/soil mixtures, asphalt membrane, and polymeric membranes have been used successfully. In choosing a liner or capping material, some important properties to consider include impedance to water percolation, ability to support vehicular traffic and heavy equipment, freeze/thaw stability, crack resistance upon settlement, resistance to root penetration, resistance to biological and chemical degradation, and life expectancy of the material.

Clay has been the most common material used in landfills. It is abundant, impermeable, biologically stable, and has also demonstrated the ability to self-heal when solid subsidence occurs. Bentonite is a type of construction material made from clay that tends to swell when saturated with fresh water. Its properties are similar to that of clay.

Several types of polymeric (plastic or rubber-based) materials are available for impermeable barriers. The materials come in different thicknesses where the thicker the material, the more effective it is. Resistance to tear, puncture, and chemicals, along with the material's cost, generally increases with thickness. The minimum thickness used is 20 mils, while a 30-mil thickness is preferable. Each material has certain advantages and disadvantages which should be carefully weighed in selecting the material.



CLAY OR BENTONITE/SOIL CAP SYSTEM DESIGN
AND WATER BALANCE

Figure 1-4. A Schematic of a Properly Closed Landfill

2.6 Reuse of Landfills

Landfills have often been reused as parks, playgrounds, and other recreational facilities. With proper closure procedures (i.e., compaction, capping, and gas control), such uses are appropriate. Industrial office structures have been built on some landfills; settlement, however, may continue for 25 years or more. Soils and foundation-related testing are essential before development, in order to determine whether settlement of the landfill is occurring and when it might cease. Placement of major structures on a landfilled site requires special design and construction techniques.

For any type of reuse plans, an investigation of the historical practices of the landfill should be undertaken. This investigation should determine the types of wastes handled, the nature of the compaction and daily cover operations, and the procedure followed for closure. Groundwater and gas monitoring should also be included in the predevelopment phase. For proposed landfill uses which require heavy surface loads--from buildings, construction equipment, or other heavy traffic--it is prudent to include extensive soil testing to determine the soil's ability to withstand the predicted loads.

2.7 Proposed Regulations

The Masschusetts DEQE is in the process of updating its regulations (authorized largely under Section 150A of Chapter 111, Mass. Gen. Laws) regarding landfill disposal of solid wastes. The current landfill regulations, promulgated in 1971, are now outdated. These regulations were put into effect mainly to end the practice of open burning; unfortunately, not all of the additional practices with adverse environmental impacts were addressed.

The new regulations are scheduled to be completed by early 1986. In February 1983, a public discussion draft of revisions to the 1971 regulations was issued. The revisions include new minimum criteria for siting, constructing, and managing landfills. Major revisions include the following:

- Prohibition of siting a landfill in a 100-year floodplain or within 100 feet of a wetland or surface water
- Prohibition of siting a landfill in the watershed of Class A surface water bodies and in the primary sand and gravel recharge areas of significant groundwater aquifers
- Inclusion of a site-specific hydrogeological study prior to design of a landfill
- Use of artificial liners and a leachate collection, removal, and disposal system to control leachate
- Installation of at least one monitoring well hydraulically upgradient and three such wells hydraulically downgradient at the site, along with an approved groundwater monitoring program
- Prohibition of depositing refuse closer than five feet above the maximum groundwater elevation
- Prohibition of the disposal of hazardous wastes
- Placement of an intermediate cover on any part of a landfill whcih will remain inactive for more than one month
- Placement of a final cover consisting of 6 inches of cover, 12 inches of an impervious material, and 6 inches of material capable of supporting vegetative growth.

These new regulations, when enacted, should represent a significant improvement over the current ones. It is of utmost importance that new landfills be designed and constructed to prevent ground and surface water contamination. While the additional protection measures will require greater expenditures today, far greater costs for remedial action in the future can be avoided.

3. Resource Recovery

3.1 Introduction

Resource recovery is not a new technology; using municipal solid waste to produce energy has been practiced since the late nineteenth century. The first reported system was in Germany, with the first U.S. facility developed in New York shortly thereafter. At that time, the steam by-product of combustion was only used for meeting facility needs. With the drop in fuel costs, these waste-to-energy plants soon diminished in the U.S.

As oil prices began to rise in the early 1970s, an interest in alternative energy sources resurged. Further, an awareness and concern for protecting the environment ushered in new environmental protection regulations. These regulations required stricter control on land uses, such as landfills, and thus increased their costs. The increasing cost of landfill disposal meant that energy recovery from the incineration of municipal solid waste appeared to be an attractive alternative.

Having earlier faced the problems of high fuel costs and limited land availability, several European countries and Japan had been using waste-to-energy facilities successfully for years. Several facilities are now operating in the U.S., with more in the construction and planning stages. As of early 1985, 87 facilities were currently operating in the U.S., with 41 more under construction and 124 in the planning stage.

With the limited amount of land available for landfilling coupled with a significant dependence on groundwater, eastern Massachusetts is facing a solid waste disposal dilemma. Continued use and expansion of existing landfills threatens water supplies, while siting of new landfills is either impossible or prohibitively expensive. Yet, as space fills up in existing landfills, there are few alternatives available for immediate disposal. It is therefore important for local officials and citizens to understand what alternative waste-to-energy facilities offer, as well as other considerations relevant in making a long-term decision on a disposal method.

3.2 Technologies

Waste-to-energy facilities are often referred to as "resource recovery" systems, the "resources" recovered include energy and, possibly, ferrous metals, glass, and paper. Depending upon the system, the ability to recover materials varies. There are three basic technologies in use for converting refuse to energy and several variations under each category. The three technologies are: (1) mass burning, (2) refuse-derived fuel (RDF), and (3) a nonburning, cellulitic fiber production process (ORFA). Of the existing facilities in the U.S., 71% use mass burn while 25% produce RDF. A discussion of these three systems follows.

3.2.1 Mass Burn

Mass-burning is a proven, European technology. Basically, the mass-burn system incinerates the incoming waste as is, with little or no separation. This is the simplest technology, in that preliminary processing is essentially eliminated. Direct combustion and modular incineration are the two basic methods of mass-burn available. Direct combustion systems generally handle larger volumes of refuse, while modular incineration systems are smaller and may process as little as 15 to 250 tons per day of refuse. The combustion system is similar for both.

Figure 1-5 illustrates the mass-burn process. Municipal solid waste is deposited onto a tipping floor or into a large storage pit, from which a crane transfers it to the furnace feed hopper. From the feed hopper, the waste is fed onto a mechanical grate system where it burns while moving continuously through the furnace. Noncombustible material falls off the end of the grate where it is quenched with water and then conveyed to a temporary storage pit or to waiting trucks. It is common for ferrous metals to be recovered from the residue.

Heat from the burning refuse is captured and used to produce steam in the attached boilers. The steam that is produced is then usable as is or can be converted to electricity through a turbine generator. The energy is generally used for in-plant needs and then sold to available energy markets.

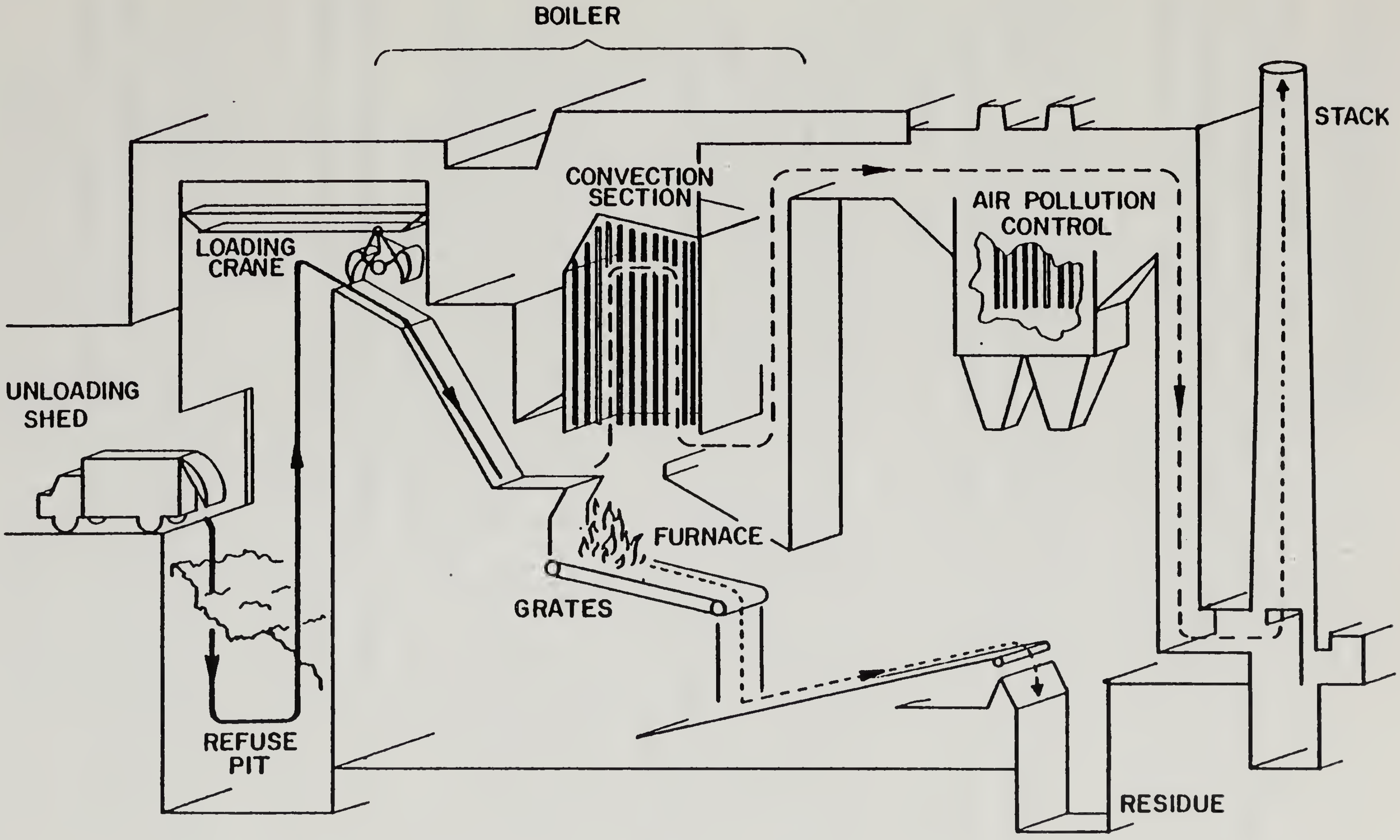


Figure 1-5. Typical Waterwall Furnace for Unprocessed Solid Waste.

Gases are released from the combustion process and are cooled as they pass through the boiler. After the gas is cooled, it passes through air pollution control devices (e.g., electrostatic precipitators (ESP), dry or wet scrubbers, etc.) and is then vented to the atmosphere through the stack. The particulates accumulated from the ESP, called fly ash, are collected and temporarily stored or disposed. Wet scrubbers also produce a sludge which requires final disposal.

Two types of incinerators are available in the direct combustion system, the refractory-lined incinerator and the waterwall incinerator. The walls of refractory-lined incinerators have a temperature-resistant coating which conserves heat from the combustion process. However, large quantities of air are required to cool these walls. As this air must be treated in the pollution control system, operational costs are higher for this type of combustion. The steam produced in refractory incinerators is generally lower in temperature and pressure than that produced in a waterwall system. Refractory-lined incinerators, however, have a lower boiler tube corrosion rate so some savings are available in the area of plant maintenance.

Waterwall incinerators, as the name implies, are made up of small water-filled tubes which cool the furnace. They require less air than refractory-lined incinerators; thus, air pollution control equipment, fans, and the combustion chamber are smaller. The operational costs are also lower. The waterwall incinerator was developed after the refractory-lined incinerator and generally produces higher quality energy (higher Btu value) at less cost. Nonetheless, both systems are currently in use and both are proven technologies.

Modular incineration is so called because the systems are manufactured in components: the combustion chamber, boiler, and so on. Modules are assembled on-site and vary in size from 12.5 to 100 tons per day. Often, several modules are grouped together, increasing the capacity up to 400 tons per day. Originally, modular systems produced a low Btu gas; however, modular direct combustion units are becoming more popular.

3.2.2 Refuse-Derived Fuel (RDF)

Refuse-derived fuel (RDF) plants have become more widely used in recent years, although there are still fewer of them than massburn plants. Approximately 15 facilities are on-line or under construction in various sections of this country.

The basic differences between the RDF and mass-burn processes are: a) materials separation and volume reduction occur as an integral part of the process, and b) creation of a solid (i.e., nongaseous or liquid) fuel product. The system is briefly summarized as follows and illustrated in Figure 1-6:

> Incoming refuse is unloaded to a tipping floor and then mechanically conveyed to one or more processing lines. Next, a removal procedure occurs in which oversized and unprocessible materials, such as stones and organics, are removed by a conveyor system, using frontend loading devices and grappling hooks to transport these items. Most of this material is removed to a landfill. The waste then is transported to a primary shredder (usually a vertical structure with a hammering mechanism), where 85% to 90% of the refuse is reduced to particles of 3 or 4 inches in approximate size. Along with primary reduction, magnetic extraction removes all ferrous metals for direct shipment to purchasers.

Also, odd-sized materials are screened out and sent to a landfill, while properly sized particles become the actual RDF product. The most common screening method is the rotary trommel, a rotating, perforated cylinder with a graduated system of "holes." Screening discs and air classification systems are used as well. Various additional extraction processes may occur, such as glass removal and shredding, with transport to a landfill or, in some cases, market resale. Aluminum, too, may be removed and sold separately.

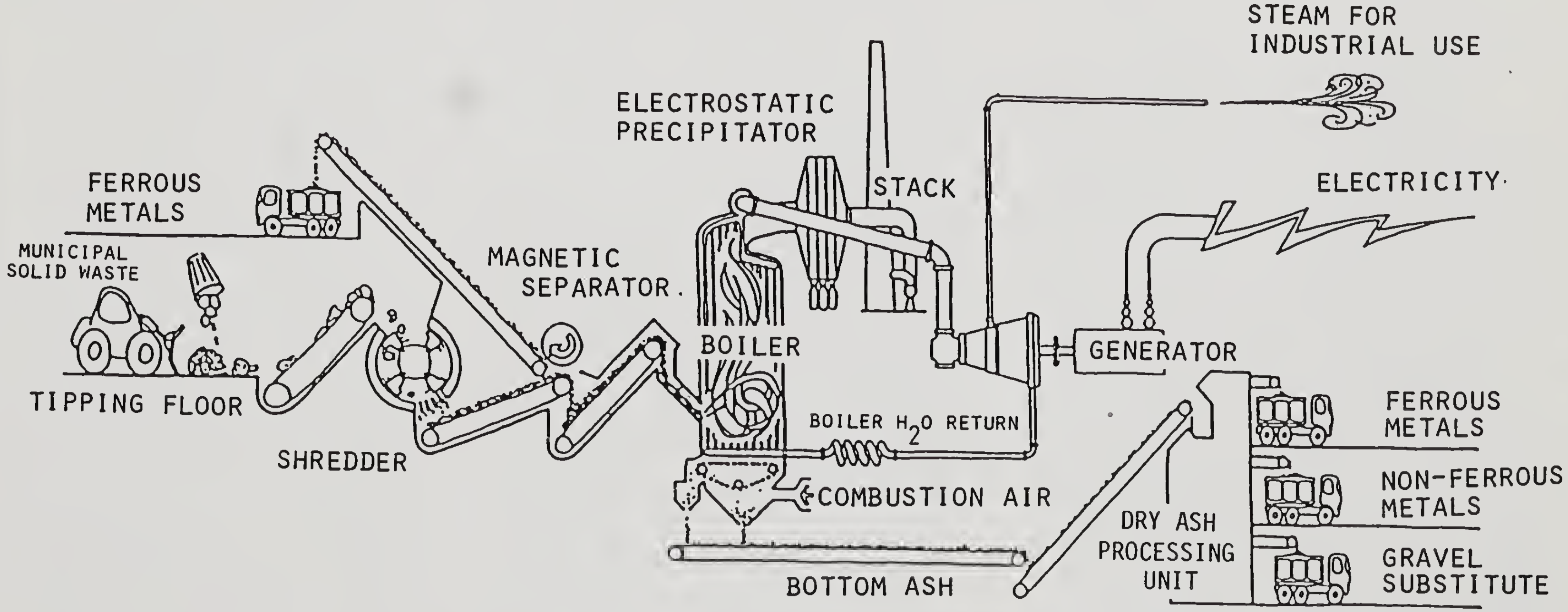


Figure 1-6. Refused Derived Fuel System (Semass)

Source: Energy Answers, Inc.
Southeastern Mass. Resources Recovery District

The fuel may take any of several different forms, depending upon the engineering design of the given system and the intended use of the fuel. The RDF may consist of any of the following types: coarse (or fluff); fine; compacted pellets or bricks; RDF powder, formed mechanically, chemically and/or thermally; or wet-pulped fuel, which can be combined with sewage sludge. Each type has its own advantages and disadvantages, in terms of the exact applicability, as well as combustibility, efficiency, environmental impact, cost, safety, ease of storage and handling, and whether or not a dedicated boiler (that is integrated into the RDF system) is required.

After the RDF plant produces the fuel, the whole second phase, in the form of the thermal conversion process, must occur. The burning (or co-burning with fossil fuels) process, the conversion to and sale of steam, and the generation and sale of electricity may take place in an on-site integrated system with dedicated boilers or in an entirely different location.

The RDF boilers are generally constructed with a water-cooled membrane wall with the capacity to burn the RDF together with fossil fuels, at typical maximum temperatures of 750^{o} Fahrenheit. Electrostatic precipitators treat exhaust gases and residual ash, normally less than that produced in mass-burn facilities, which is hauled to the landfill. A heat transfer system affects the steam conversion process, both to drive the turbine generators and to produce process steam.

RDF, like any disposal method, tends to have certain operating problems. The most often cited ones are:

- During the shredding process, explosions and fires have been known to occur, largely due to improper disposal of flammable substances, with additional potential danger from ambient particulate matter.
- The shredding/hammering structure needs constant maintenance and frequent replacement.
- The various conveyor systems at the fuel plant are subject to breakdown.
- Some observers have noted that RDF, particularly the loose form, creates messy site conditions by blowing and drifting.

The industry employs a number of practices to address the shredding safety issue. These techniques include: diligent visual examination of incoming materials; identification of habitual "offenders", those whose waste is known to contain explodable materials; installation of explosion venting systems and fire suppression equipment; installation of water devices; and use of elaborate detection devices.

With regard to the shredder maintenance and conveyor problems, the industry has gradually made improvements, based largely on trial and error. The RDF drifting litter problem can be eliminated, according to industry spokesmen, if careful control measures are instituted.

Finally, there is the ongoing marketing rivalry between RDF and mass-burn technologies, with each claiming the superiority of their process. The mass-burn operators claim that RDF has safety problems, can be unsightly and that preprocessing is too cumbersome and energy-consumptive. They feel strongly that the constant need to pursue economic markets for the unburned, usable materials is an inherent weakness. The mass-burn proponents also criticize extra transportation costs arising from transporting the RDF to off-site thermal energy facilities.

On the other hand, RDF operators have noted that some mass-burn plants, at least in the past, have had excessive downtime. All resource recovery facilities aspire to 90% efficiency. RDF proponents also feel that energy recovery efficiency claims are exaggerated. Most of all, they express concern over air pollution problems at some mass-burn facilities. The RDF proponents also contend that their total process, because it is multimodal, removes more waste from landfills, including disposed ash.

3.2.3 ORFA

The third resource recovery technology presented in this study is a recent arrival in Massachusetts. ORFA Corporation of America has exclusive license to market their proprietary disposal process: a self-contained, nonburning process that separates out ferrous metals and bulky items. The remaining waste goes through a shredding, separation, drying, sterilization, and stabilization process that generates two end products.

The primary end product is a sterile, stable, odorless, cellulitic fiber called ORFA fiber. Proponents of the process claim that this fiber has numerous uses, among them fuel pellets, building materials, paper, and agricultural products. The secondary end product is a granulate consisting of nonferrous metal, glass, gravel, and plastic which proponents claim can be used in masonry products and roadfill.

According to ORFA, the advantages of this system are that it is fully automated, self-contained, nonburning, and that it releases no particulates, gases, or wastewater into the environment. The process also may be useful to communities or groups of communities with a smaller waste stream than would be necessary to support a financially feasible mass-burn or RDF facility.

There are several areas which communities considering an ORFA facility should examine thoroughly:

- The history of operation and the amount of downtime, both for regular maintenance and unexpected breakdowns.
- The availability of a backup facility or landfill.
- The markets for recovered materials--if purchasers are willing to sign contracts to buy the materials where the length of the contract is at least the same length as the contracts the communities sign with the facility.
- The quality of recovered materials should be uniform and high enough that there is no reason a purchaser would refuse to accept the materials.
- The cost per ton of incoming waste after revenues have been subtracted should be something communities can live with for the entire term of the contract.

Two ORFA facilities are presently under construction: one in Somerville, Massachusetts and the other in Philadelphia, Pennsylvania. There is less information available on actual operating history for this type of facility than for the two discussed earlier. A major question for communities considering an ORFA facility will be what happens to waste generated if the facility is not operating due to a breakdown or routine maintenance.

Markets for the two end products are crucial to the success of the system. Company officials indicate that the precise end products will be tailored to industrial and business demand near the facility. Long-term markets with a contractual obligation to purchase the products are just as necessary with an ORFA facility as they are for mass-burn and RDF plants. A constant revenue stream from the sale of end products will be required to support construction and operation of the facility.

For communities with limited budgets, the cost per ton for disposal is critical. Community officials must compare the total cost of disposal at an ORFA facility with that offered by other processes.

3.3 Energy Products and Markets

Resource recovery offers a variety of energy products from solid waste. The fuel may be in the form of a solid, liquid, or gas, as well as steam and electricity. An important consideration in determining the most appropriate resource recovery technology is the market available for the energy product and the availability of a long-term commitment to purchase the energy. The characteristics of the fuel should be known to determine its marketability.

Among the fuel characteristics which should be considered are the quantity of fuel produced, its heat value, the reliability of the supply, and the fuel quality. A sufficient fuel supply must be available to offset costs for construction or plant modifications necessary for accepting the new fuel. A fuel should have a high enough heat value to burn efficiently in a boiler or furnace. Fuels with lower heat values must be available in larger quantities, thereby raising transportation, storage, and handling costs. Reliability of the supply is an important factor; the fuel value increases for a reliable supply as the user does not need to maintain an alternate fuel source. A high quality fuel, in terms of its ease of handling, uniformity, stability, and Btu value, is more salable.

A wide range of market options is available for refuse-to-energy products. RDF facilities without a boiler may sell the fuel to different users, whereas those facilities which burn the RDF can market steam and/or electricity. Mass-burn facilities include the incineration process and also market steam and/or electricity.

The best markets for RDF include steam electric power plants, industrial operations, and central heating/cooling plants. Electric utilities which operate steam-electric plants fired by fossil fuel provide the optimum market because of the large quantities of fuel used and because they tend to be located near centers of waste generation. The boilers at these facilities should be capable of burning RDF alone or with another fuel. Industrial operations such as generating plants, paper mills, and steel mills use large quantities of fuel.

Both RDF facilities with boilers and mass-burn facilities produce steam and/or electricity for marketing. Steam can be marketed in two ways: (1) as a guaranteed supply or (2) as a limited supply requiring a back-up system. In the first case, the producer--a municipality, a private company, a public authority--provides a reliable supply and is responsible for providing steam from other sources if an interruption in normal operation occurs. In the second case, the customer purchases all the steam available and is responsible for making up the deficit if the supply is insufficient.

There are numerous commercial and campus district steam heating systems operating across the country. In these systems, steam is generally distributed at low pressures, which resource recovery facilities can easily supply. Large industrial facilities such as paper mills, food processors, and other industrial facilities operating 24 hours a day, 7 days a week make excellent customers for steam, as their boilers are designed for round-the-clock operation.

3.4 Environmental Considerations

While resource recovery reduces the waste stream 85 to 90 percent by volume, incinerator ash, noncombustibles, and other large nonprocessable items (such as refrigerators, stoves, and automobiles) do require alternate disposal methods. Additionally, a disposal option must be available when the facility is not operating. Landfills have provided this back-up capability. Landfills have been used for disposal, which requires addressing stringent environmental quality regulations.

Incinerator residue, or ash, is a by-product of the incineration process. The residue consists of two components, bottom ash and fly ash. Bottom ash generally consists of ash clinkers, slag, glass, ceramics, and metals, whereas fly ash contains fine particulates accumulated in the air pollution control equipment. The two components are separable; however, most resource recovery facilities combine the two prior to disposal. Figure 1-7 shows one backend (post-combustion) materials recovery process for separating ferrous and nonferrous metals from bottom ash.

The physical and chemical characteristics of the ash residue vary from facility to facility, according to the processing and the type of waste. In Massachusetts, incinerators may burn commercial and industrial wastes along with domestic wastes. However, when nonresidential wastes are included, it is required that the ash be tested for potentially hazardous constituents under the provisions of the Resource Recovery and Conservation Act of 1976 (RCRA). Some of the hazardous constituents potentially found in ash include high concentrations of lead, cadmium, zinc, and potassium, along with organic compounds.

The University of Massachusetts at Amherst and Massachusetts DEQE are currently studying the contamination potential of ash disposed in landfills. The results should determine whether incinerator ash constitutes a hazardous waste. If DEQE finds the ash to be hazardous, a site licensed to accept such hazardous wastes must be used. Massachusetts currently has no hazardous waste disposal facility; the closest is in New York.

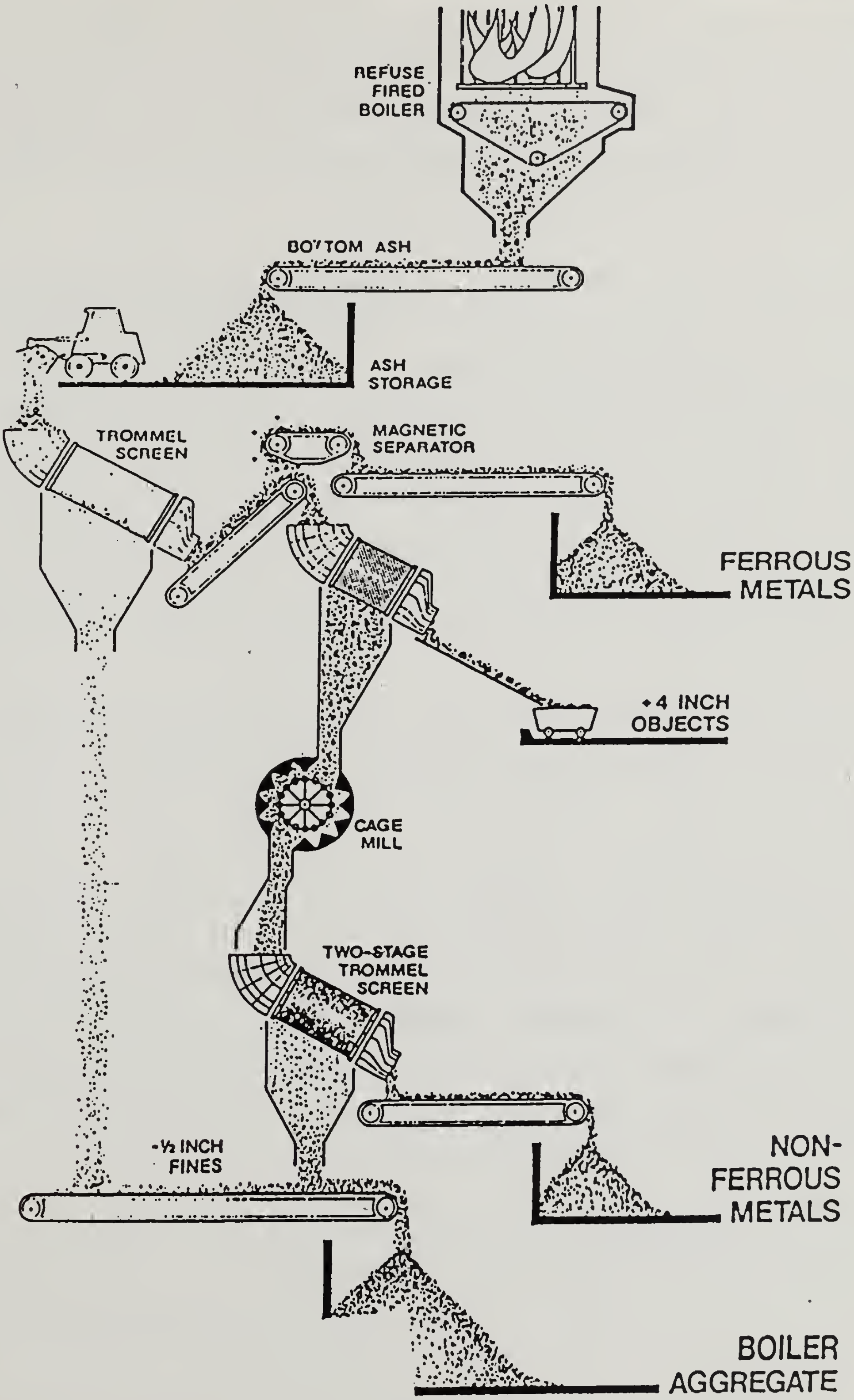


Figure 1-7. Ash Processing Center

Source: Smith & Mahoney, P.C. Consulting Engineers

Because of the large quantities of ash generated, there has been a considerable amount of research done on innovative uses for the ash. Potential uses include subbase for road construction; aggregate in masonry blocks for septic tanks, foundation, and partition walls; lawn and garden ornaments; and landfill cover material.

The second major environmental impact resulting from resource recovery facilities concerns air quality. Like any combustion facility, resource recovery plants emit particulates and other potentially harmful elements into the air. Among the major stack emissions are particulate matter, sulfur dioxide, nitrogen dioxide, carbon monoxide, hydrogen chloride, hydrocarbons, lead, water vapor, and possibly dioxins. These emissions result from the incineration process and to some extent depend upon the composition of the waste. Basic standards require 99.99% destruction and removal efficiency for each major hazardous component of the waste.

The one outstanding concern with mass-burn and RDF facilities is the possibility that they emit dioxin and other pollutants as a by-product of waste combustion. There have not been any conclusive studies done that show dioxin actually produced by burning solid waste in modern resource recovery facilities. However, studies are necessary to establish whether dioxins (and/or other pollutants) are produced, what is causing the production, if the pollutants can be removed, and if production of pollutants can be avoided. The MAPC encourages communities to begin planning efforts as soon as possible. Then, by the time communities are ready to commit to a particular technology or vendor, answers to air emission questions should be available.

EPA has developed New Source Performance Standards based on the best systems that have effectively reduced emissions. These standards apply to new facilities and existing ones that have been modified after the establishment of EPA criteria. The Massachusetts DEQE requires incinerators to incorporate the Best Available Control Technology (BACT) to meet EPA's standards. Recently, the BACT in use has been based on the performance of electrostatic precipitators (ESPs). ESPs are effective in removing particulates from incinerator flue gases, but do little to remove gaseous emissions. An alternative control device, wet scrubbers, controls both gaseous and particulate emissions. DEQE is currently requiring new resource recovery facilities to use scrubbers as a more effective control technology.

3.5 Resource Recovery in Massachusetts

Resource recovery is no longer an experimental disposal option used by a few Massachusetts communities. Table 1-11 is a comparison of the major resource recovery facilities in the Commonwealth. Three facilities are in the planning stage, one is under construction, and four are in operation. The City of Boston has also recently made a decision on resource recovery: one-half of the city's waste will be disposed at RESCO and the other half at the SEMASS facility in Rochester, Massachusetts. Assuming that all eight of these facilities eventually begin operation, the total amount of refuse handled by these facilities will amount to 2,950,200 tons per year or 50% of the total amount generated in the Commonwealth.

Each of these facilities resulted from an extensive planning process. Some facilities have a mix of public and private participation. The Massachusetts Bureau of Solid Waste Disposal took an active role in planning one of these facilities: the NESWC plant in North Andover. The facility site is owned by the Commonwealth and leased to Massachusetts REFUSETECH, Inc. (MRI), the owner/operator. The Commonwealth will also assume operating responsibility for the back-up landfill, probably on a private contract basis. The landfill is owned by the City of Peabody. Another unique feature of the NESWC project is an intercommunity agreement whereby towns near the site partially subsidize transportation costs for more distant communities.

Choosing a resource recovery facility has been a lengthy, complex, time-consuming process for Massachusetts communities. There are several reasons for this, among them:

Table 1-11

Resource Recovery Facilities in Massachusetts

Facility/ Location/ Owner	Type	Design Capacity (TPD)	Products/ Markets	Start-up Date	Service Area	Landfill Site	Tipping Fee	Contract Length (Years)
RESCO/Saugus Signal	Mass-burn	1200	Steam	1975	North Shore	Saugus	$19.84*	20
Refuse Fuels Inc/ Haverhill	RDF	1300	Electricity-Mass Electric Steam-Industries, housing, papermills Cardboard-New England Ferrous-out of state	1984	Merrimack Valley	Haverhill	$30 contract	20
NESWC/North Andover/Signal	Mass-burn	1500	Electricity-NE Power Ferrous	1985	Northeastern Mass.	Peabody	$25 contract $26-28 spot	20
Vicon/Pittsfield Vicon Recovery Systems	Mass-burn	240	Steam-Crane Paper Co.	1981	Greater Pittsfield area	Pittsfield	$15 contract $15 spot (winter months only)	15
ORFA/Somerville ORFA	ORFA	330	Fiber - Granulate-	1986	Somerville			
SEMASS/Rochester/ Energy/Answers	RDF	1200	Electricity-ComElectric Metals Bottom ash-landfill cover	1988	South Eastern Mass	Carver-Marion-Wareham	$17.20**	27
CMRRC/Millbury/ Signal	Mass-burn	1500		1988	Central Mass.	Grafton?	$26.50	20
HERCO/Holyoke/ HERCO,Ebasco	Mass-burn	800	Electricity-Northeast Utilities Steam-Holyoke Gas & Electric	1988	Connecticut Valley	Chicopee Granby		

*$19.84 for original
$26.00 for new communities
$35.00 for spot dumping

**$17.20 for year one first 500 tons
17.20 + 50% CPI for second 500 tons
market rate
fees to be adjusted after year one

1. Lack of an existing regional governmental entity to coordinate planning, construction, and operation of a facility.
2. The choice between available technologies is not clear cut; each group of communities must balance tonnage, environmental considerations, siting concerns, contractual issues, markets for recovered resources, costs, and other issues to determine which technology best suits their needs.
3. Markets for recovered resources, including energy, may be difficult to find, may not offer long-term contracts, and may offer low prices for recovered materials.
4. Financing plans are complex, with several methods available. Each has advantages and disadvantages which must be considered before a decision is made.
5. Many environmental considerations affect the technology chosen, as well as the backup landfill. There are unanswered questions and changing regulations.
6. Complex contractual issues have to be worked out, such as ownership of the site, the facility, and the waste stream; treatment of revenues and profits; payment for retrofitting any required alterations; provision of insurance; and disposition of the facility at the end of the contract period.
7. Transportation costs can vary significantly from one community to another, meaning that communities with high collection and transportation costs may not be able to afford a more costly facility.

In deciding to support a regional resource recovery facility, communities are making a long-term choice of disposal method. Officials must recognize this and be ready to address the many smaller decisions which must be made before construction of the facility can begin.

4. Volume Reduction Methods

4.1 Introduction

In addition to landfilling and resource recovery, there are several other methods of volume reduction and/or disposal, including incineration (without energy or materials recovery), composting, baling, shredding, and recycling. There are also several types of waste that require special disposal methods: sludge, demolition waste, tires, and tree stumps.

4.2 Incineration

Incineration is one way to reduce the volume of solid waste requiring disposal. Like resource recovery facilities, incinerators burn refuse, reducing the volume by 80 to 90 percent; permit recycling through separation; and require disposal of ash and other residues. Incinerators have been operating since 1920; several are still operating today with various modifications, most frequently for pollution control.

Conventional refractory-lined incinerators designed to process 50 to 300 tons of waste per day are the most common type in use. Large quantities of air are required as a cooling medium, meaning that the air pollution control system must be large enough to handle the air and particulates. Many of the existing incinerators were not equipped with the stringent air pollution control devices that are now required. Thus, retrofitting the units is necessary and can be an expensive proposition.

By comparison, most resource recovery facilities today use waterwall incineration, which is cooled by water and therefore requires less air. Waterwall incinerators cost almost one-fourth less to build and two-thirds less to operate. In addition, the sale of steam or electricity generates revenues to help offset the processing cost.

A relatively new development is the use of smaller incinerators with capacities between 5 and 12 tons per day. These small incinerators have been used by individual communities and by some industries. Often, more than one unit is purchased for back-up capacity. Because use of these smaller units is so recent, extensive information on operating costs is not yet available.

An auxiliary fuel, either natural gas or fuel oil, is required for startup, for maintenance of furnace temperatures, and for the afterburner (part of the pollution control system).

Among the advantages of small incinerators are that individual towns may operate them and they are easily purchased. However, they require an auxiliary fuel and, because of their smaller capacity and noncontinuous operating conditions, they do not offer the potential for energy recovery.

In general, incinerators offer another alternative for reducing waste volumes; they are particularly useful when long-distance hauling and disposal would otherwise be necessary. Incinerators, however, do require a large initial capital investment and have high operating costs. Trained operators are necessary to ensure proper maintenance of the unit. For communities already possessing an incinerator, it is important to determine what costs are involved in retrofitting to meet current air quality standards and what the operating costs will be.

4.3 Composting

Composting the organic fraction of municipal solid waste is another way of reducing its volume, cutting odors, eliminating pathogens, and producing a useful end product. Removing the organic material from the waste stream can also reduce pressure on landfills, increase the Btu value of waste to be incinerated, and/or reduce tipping fees and transfer haul costs. Municipal solid waste can be composted by itself or mixed with sludge from a wastewater treatment plant (co-disposal).

In either case, the inert, inorganic portion of the waste stream (e.g., glass, cans, white goods, tires) must be removed before composting, either by the homeowner discarding waste separately or by shredding and separating the accumulated waste before composting. The method used to separate the waste stream will require analysis by a community considering a composting system; while separation by the household may seem more efficient, separate collection is then required. On the other hand, shredding and separating accumulated waste allows for less expensive collection programs.

Once the organic fraction has been separated, it is cured, then stored until is is used or sold.

There are several reasons why composting is not used more frequently as a disposal method for municipal solid waste. First, the collection versus separation problem described above. Second, the cost of equipment for aerating and moving the compost around. Third, the space required can be difficult to find in some communities, especially a site of sufficient size which will not be opposed by neighbors. A fourth reason is the lack of established commercial markets for the finished compost.

Because of the need for an isolated site and the necessity for separating wastes, traditional composting programs work best in smaller rural or semi-rual communities where land is instituted to handle the inorganic fraction of the waste stream.

However, other communities can make limited use of composting to help reduce the volume of waste which requires another disposal method. Rather than try to compost all of the organic fraction of their waste stream communities can compost just the yard waste produced by residents. This waste is the easiest to separate; since it is collected outside the home it is less likely to contain a variety of inorganic (noncompostable) wastes. Also, since food waste is not involved, both perceived and actual odors from the composting process are likely to be less. Lastly, the community can use the resulting compost in place of loam, thereby saving both the cost to dispose of the yard waste at the outset and the loam it would have had to buy for use on playing fields, flower beds, and so forth.

4.4 Baling

Reducing the volume of solid waste prior to disposal offers cost savings to communities for transfer and hauling as well as for ultimate disposal. By reducing the volume, more refuse can be transported at one time and more waste can be disposed of in a given amount of landfill space.

Baling represents one such volume reduction method. There are three major types of balers in use today. One type compresses the waste so that baling wire is not required. Another type preshreds the waste into a homogeneous material. A third type of baler requires no preprocessing, but tie-wires are necessary.

Baling has many advantages as a volume reduction method. To begin with, the life of landfills is increased through baling. Balers can handle most materials, and baled waste is easier to handle than loose, unprocessed waste. Baling also allows for recycling of materials, such as ferrous metals, corrugated containers, and white goods.

Among the disadvantages of baling is that it precludes resource recovery once the bale is formed, due to the heavy compaction involved. Generally, a greater initial capital investment is required than for a transfer station. In addition, the effects of the decomposition of the bales in landfills is currently unknown.

As a general rule, baling can be effective for communities or groups of communities generating more than 400 tons per day of waste, especially if land is unavailable nearby and long-distance hauling is required. According to the Decision-Makers Guide to Solid Waste Disposal (EPA, 1980), the advantages and disadvantages of baling should be considered when planning solid waste disposal for a community and/or group of communities.

4.5 Shredding

Shredding represents another volume reduction method; it involves pulverizing, milling, and grinding wastes to a smaller size. The greatest advantage shredding offers is the high level of volume reduction achieved. Shredded waste compacted in a landfill may yield compaction densities 25 to 60% greater than unshredded wastes. Moreover, shredding of large, bulky items facilitates incineration. It is for this reason that some resource recovery facilities (such as refuse derived fuel facilities) preshred waste prior to combustion. Also, experience indicates that landfilling shredded waste eliminates a large portion of the objectionable odors and does not tend to attract insects, rodents, and other pests.

Shredding, like baling, offers several advantages to the public. It increases landfill capacities, and shredded waste is easily placed and compacted. It has even been landfilled without cover material. Leachate collection, treatment, and disposal, however, are still required to protect groundwater. Shredding equipment and operating costs are relatively low compared to other volume reduction processes. Shredding also permits separation for recycling and is compatible with resource recovery.

While shredding is an effective means of reducing the volume of solid waste, there are some problems with the process and shredding operations. The shredding equipment jams and tends to wear out quickly. Flammables and aerosol cans in the waste stream may cause fires and explosions; the presence of dust from of the shredding process can present danger of combustion.

Communities considering volume reduction measures must weigh the advantages shredding can provide--increased disposal capacity, reduced disposal costs, opportunity for recycling--against any disadvantages such as equipment and operational problems.

4.6 Recycling

Prior to the 1970s, recycling was considered an economic activity predominantly for the purpose of recovering salvage; recycling was not viewed as a means of waste reduction. During the 1970s, when environmental concerns took a more prominent position, recycling efforts became more widespread. Aside from any economic benefits, the merits of recycling focused on the environmental effects, such as less litter and preservation of resources. More operators entered the business commercially, while community groups organized paper, bottle, and can collection drives, but these were generally one-time only events. Over time, recycling efforts were judged solely on their ability to produce revenue; if a recycling center's operational costs outweighed the perceived benefits, it was deemed uneconomical and ineffective.

Today, recycling is no longer considered a "boy scout" initiative. Cities and towns across the country have instituted successful recycling programs. Numerous private, contractual operators have entered the field on a relatively large scale nationwide. San Francisco recycles 22% of its waste stream, Seattle recycles 18%, Austin recycles 20%. Closer to home, Wellesley has had a recycling center since 1971, which recycles 15% of the waste stream. Approximately 70 towns in Massachusetts participate in some type of recycling program. The state of New Jersey recycles over 10% of its wastes.

With the dwindling supply of land available for landfilling, recycling offers an effective and environmentally sound means of reducing the solid waste flow and, in turn, increasing the life of a landfill. And, with today's rising disposal costs, recycling can decrease the financial burden with which communities are faced. To evaluate recycling programs more equitably, a community should consider the "avoided cost" of recycling. That is, the operational costs of the recycling program should be weighed against the disposal costs avoided (tipping fees), plus revenues generated. When viewed in this light, recycling becomes a more cost-effective step for addressing a portion of a community's solid waste problem.

Recycling as a waste reduction method involves collecting reusable materials, processing them, and reintroducing them into the market for manufacturing processes. The foundation for recycling lies in source separation, that is, segregating the wastes at the point of generation. For a homeowner, recycling might require separating newspaper and magazines from glass and metallic materials. Once separated, the materials are taken to a central recycling center. From the recycling center, the separated materials are transported to a processing facility, where the recyclables are transformed into raw materials. The raw materials are then sold to industrial markets for reprocessing into marketable items.

4.6.1 What Can be Recycled

Paper, glass, and metals are the most common materials recycled out of the waste stream. Table 1-12 indicates the amount of recyclable material which can be expected from a town with a population of 5,000.

This information indicates that the total amount of recyclable materials in a local waste stream ranges from 47.2% to 75%. The information came from two Massachusetts communities, Marblehead and Somerville. As shown in this table, paper products make up a significant portion of the waste stream, more than one-third. Paper, glass, aluminum, and ferrous metals (tin, bi-metal cans) appear to be the most promising recyclable substances. Because of their significant quantities in the waste stream coupled with their relative ease of collection and separation, there are markets available for the reprocessed products. What follows is an overview of the various materials, their potential reuse and required processing.

Table 1-12

Recyclable Materials As Percent Of Total Residential Waste

Material	Percentage of Total Waste	
Paper		30-40
-Newsprint	9-15	
-Magazine	1-3	
-Corrugated	1-2	
-Other	19-20	
Glass, Beverage		7-16
-Clear	4-9	
-Green	2-4	
-Brown	1-3	
Glass, Other		6.5-10
-Clear	5-6	
-Green	1-3	
-Brown	0.5-1	
Ferrous, Beverage		0.5-2
Ferrous, Other		3-5
Aluminum, Beverage		0.1-1
Aluminum, Other		0.1-1
TOTAL RECYCLABLE REFUSE		47.2-75

Source: Source Separation Collection and Processing Equipment: A User's Guide. US Environmental Protection Agency. 1980. p.1

Paper

Paper has been the most successfully recycled material due to its abundance and ease of separation and handling. Many recycling programs handle paper only. Recycling paper is effective in reducing pollution and energy costs along with conserving natural resources. It has been reported that the paper industry is the third largest consumer of energy in the United States and the largest industrial user of fuel oil; recycling paper can save up to 70% in energy costs.

Waste paper or "paper stock" requires certain treatment before it can be used in paper manufacturing. Rubber bands, paper clips, and other contaminants must be removed before it can be reused. It is then classified according to quality or the method by which it was produced. Shredding and repulping follows. The fibers then go through a de-inking treatment which removes additional contaminants such as inks and dyes. After de-inking, the fibers proceed through the regular paper production process.

Recycled paper products are of equal if not superior quality to virgin material counterparts, in most cases. They possess qualities that virgin material paper often lacks. There are a variety of new uses for recycled paper: for example, newspaper can be recycled into newsprint and old corrugated paperboard can be used for new corrugated material. Mixed grade paper has been reprocessed for packaging boxes, toilet paper, and paper towels. High grade white office paper can be used for stationery. Mixed grade paper is reusable as insulation material.

Glass

Glass scrap, called "cullet," is a valuable material in the production of glass. Cullet melts at a lower temperature than the raw materials used to make glass and therefore saves energy. The glass industry consists of three branches: (1) container (bottles, jars), (2) pressed and blown (lights, glass fiber), and (3) flat (window, plate glass). The container branch represents 45% of the glass industry's production and is also the major type of glass in municipal solid waste.

The predominant colors of glass are flint (clear), amber (brown), and green. In the United States, 65% of the market is made up of flint, 10-15% green, and the remainder is amber and other colors. Flint is therefore the most sought-after cullet and cannot be mixed with other colors. Glass manufacturing companies generally require the cullet to be free of dirt and organic contaminants, be color-sorted, and be free of metal (caps or rings).

Other than reprocessing for glass, cullet has been used for producing "glassphalt," a road paving material; for building materials, such as panels and terrazzo tile; for insulation; and for sewer pipes. Glass markets, it should be noted, have tended to fluctuate considerably.

Aluminum

Recycled aluminum is returned to the smelting plant, where it is reheated, mixed with other materials, and sent to a mill for final processing. Reusing aluminum saves about 95% of the energy which would otherwise be used to process raw ore. The aluminum market is relatively stable and eager to accept recycled aluminum.

Ferrous Metals

Ferrous metals make up roughly 5 to 7 % of the waste stream, of which about 13% is in the form of steel cans. The remainder includes large and bulky items, such as appliances. In recycling operations, the tin-coated or bi-metal cans are normally removed for recycling.

The steel industry recycles about 50% of steel scrap, of this, approximately 4% comes from residential waste. Other than cans, much of the steel found in municipal refuse is mixed, of unknown origin, and often has a high level of contamination. In order to be marketable, steel scrap must be properly processed and segregated into grade types.

Steel cans represent a more promising opportunity for metal recycling. Steel cans contain approximately 93% steel; the tin coatings provide a valuable resource. In the United States, the detinning industry (industries which remove tin from other metals) provides the sole source of tin, other than closely guarded government stockpiles. The tin removed from the cans is used to make a variety of tin-based chemicals. The remaining steel scrap can be sold to the steel industry, as it is generally of uniform quality.

4.6.2 Mandatory or Voluntary Programs

In the past, most recycling programs have been voluntary; citizens were not required by law to recycle anything from their refuse. However, more and more communities are instituting mandatory recycling; mandatory programs double the participation that voluntary programs achieve. Although it is practically impossible to enforce mandatory recycling programs, the legal framework acts as a moral and psychological impetus.

Many communities in Massachusetts have enacted mandatory recycling bylaws. Marblehead will impose a $50 find on violators of the "Refuse Bylaws of the Town of Marblehead"; the bylaws require residents to separate cardboard, newspapers and magazines, bottles and other glass containers, and aluminum, steel, and tin for recycling. Chelmsford has mandatory recycling of glass, cans, and paper and will refuse to collect unseparated trash. Newton will not accept newspapers in general refuse.

Ordinances or bylaws requiring mandatory recycling may also include an antiscavenging law. Curbside collection of separated wastes often results in unauthorized people removing the recyclables. This reduces the recyclable material and thus reduces revenues to the municipality. Antiscavenging bylaws have been passed in many communities, imposing fines ranging from $25 to $250 for offenders. For example, Chelmsford has amended its recycling bylaws to assess a $100 fine for violators.

4.6.3 Collection Techniques

One of the critical issues to resolve in implementing a recycling program is the method of collection. If collection is not convenient to the public, chances are that recyclable materials will not be separated.

Various methods of collection are available and no one method is recommended for all communities; the alternatives should be studied to determine those most appropriate for a given town. Table 1-13 defines the methods available.

Separate Collection

The separate collection method is the most convenient one for the resident, because it offers curbside pickup of separated materials. The pickup may be by separate truck or by using the regular compactor truck with a rack or piggyback system attached. Some more recent systems involve a small trailer for recyclables towed behind the compactor truck.

The separate truck method involves a collection truck which duplicates the regular refuse pickup route. Start-up costs are generally not great. Many communities use reserve trucks from their own fleet for this collection. Studies indicate that these collections result in less wear and tear on the vehicles. Smaller crews are suitable, as the quantities are less. Collection of recyclable materials may be performed less frequently than regular refuse collection.

The rack system entails a special container attached to the side or back of a regular compactor truck. Normally, rack systems have been used for paper recycling only because of smaller storage area. The first such system began in 1962 in the City of San Francisco. Rack system start-up costs tend to be somewhat higher than for separate trucks, as special equipment must be purchased or constructed. Rack systems do not, however, require separate crews; vehicle and fuel costs are reduced as well. These piggyback systems often have a higher participation rate, as the recyclables and regular refuse are collected simultaneously.

Table 1-13

Recyclable Material Collection Methods

1. Separate Collection	House-to-house collection of recyclable materials that have been segregated from general refuse (2 basic methods):
a. Rack (piggyback)	Regular refuse collection vehicles are equipped with special racks or compartments in which bundled recyclables are collected simultaneously with regular trash.
b. Separate truck	Uses separate vehicles to collect material (not in conjunction with regular refuse collection).
2. Recycling Centers	Collection points for recyclable materials to which individuals must bring their own materials.
3. Office Collection	Method of collecting high grade office paper by requiring office workers to segregate grades of paper.

Source: A Guide to Recycling: The Source Separation Way, Indiana Board of Health, 1979, p.19

Recycling Centers

Recycling centers are stationary collection depots for receiving recyclable materials. Recycling centers rely on citizen collection and transportation. This eliminates transportation costs by the public sector, but requires heavy local participation. The resident must separate, bundle, load, haul, and dispose of the recycled materials. Studies indicate that recycling centers tend to lower participation rates, but the centers are more flexible as far as types of materials they can handle, when compared to "higher-tech" methods.

As stated earlier, each community must determine which type of collection is appropriate and most cost-effective. It should be stressed that community participation is of extreme importance in any recycling program.

Collection methods which facilitate separation and collection for the householder should therefore be considered in the selection of a collection method.

Recycling is not a primary disposal technique, but a supplemental one of rising importance. It is subject to considerable fluctuation in price for various materials at different times. Recycling is not viewed as a standard technique, particularly in New England, and therefore, it can be difficult to gain acceptance for it within a community.

On the other hand, when viewed as an ancillary method that can reduce the waste stream volume and do so with the least environmental impact, recycling gains in stature. The Commonwealth of Massachusetts and the Dukakis administration think highly enough of recycling to be strongly promoting it as a current policy. Grants have been proposed for both the planning and construction of recycling facilities.

4.6.4 Processing and Marketing

Previous sections of this report have discussed recyclable materials and options for their reuse. Before these materials are reused, they require special processing in order to meet the specifications of the prospective buyers. This processing occurs at a materials recovery facility (MRF) which provides an intermediate step in the recycling process. MRFs generally involve simple sorting, densifying, and cleaning.

MRFs differ according to how the materials have been separated and the processing method required. For illustrative purposes, a facility handling two different waste streams is described below. The two streams are: (1) glass and cans and (2) paper.

For handling the glass and cans, the material is deposited into a pit feeding a conveyor. A magnetic separator separates the ferrous cans, which go into a can processor. There, the cans are cleaned, flattened, and the labels are removed automatically. The cans are then shipped to markets.

The remaining nonferrous materials, mainly glass and aluminum, are hand-sorted along the conveyor. At specific stations, sorters pick out the flint glass, the amber glass, and the green glass; aluminum cans and other salvageable materials may also be sorted out. The color-sorted glass is then fed into a glass crusher. The remaining unselected materials are then placed in landfills or shipped to a resource recovery facility. This unused portion makes up about 15% of the can and bottle volume. The glass is crushed so that no contamination--foil, metal, paper, plastic--is included with it. The glass cullet is then screened to ensure a uniform size.

The paper stream can be processed in different ways. The incoming paper can be sorted by hand or conveyor. The paper is then baled and stored; corrugated material is baled separately.

The Department of Environmental Management (DEM) has performed a market study to determine the demand for processed tin, glass, and paper which could potentially be processed in Massachusetts. Preliminary findings indicate that regional MRFs could be successful in Massachusetts; results of the preliminary report follow.

Tin can recycling involves the detinning process to remove the steel from the tin. Detinning plants in the northeast are operated by Vulcan Metals Company of Birmingham, Alabama; they also have plants in Baltimore, Maryland; Pittsburgh, Pennsylvania; and Gary, Indiana. A plant located in New Jersey was forced to close due to a lack of processable quality tin scrap. The Baltimore and Pittsburgh plants could both handle additional tonnages of tin scrap. If Massachusetts could supply greater tonnage, Vulcan would consider locating a new facility in the state. Since the tin must be of a high quality to use, cans provide the only domestic source. Vulcan has therefore invested a considerable amount of money into developing techniques to remove and process tin from unsorted refuse. Unfortunately, the plans have not yet been completely successful; this reinforces the necessity for separation of recyclables at the source rather than after they have been mixed.

Vulcan currently has paid one recyclables processor in Connecticut $62 per gross ton for processed tin cans, delivered to a rail shipping point in Newark, New Jersey. The price is based on that of no. 1 steel bundles in Philadelphia.

Glass recycling involves the production of glass cullet, which replaces several raw materials used in the production of new glass containers. Several glass companies in the northeast region offer potential markets for Massachusetts' recycled glass.

The Foster Forbes Plant in Milford, Massachusetts produces glass containers; the plant could use 45,000 tons per year of flint cullet with increases up to 100,000 tons per year. Prices of approximately $40 per ton would enable this plant to be competitive.

The Glass Container General Corporation in Dayville, Connecticut also produces glass containers. Similarly, this plant could purchase an additional 100,000 tons per year of cullet; they would also offer prices in the $40-plus per ton range.

The Owens-Corning Fiberglass Company in Delmar, New York produces fiberglass insulation. They are presently using 11% cullet, but are raising that percentage to 34%. This facility has just entered into a contract with an Ohio recycler to supply Owens-Cornings cullet requirements for the next three years.

Domglass Inc., a Canadian Company, operates three plants: one near Toronto and others in Montreal and New Brunswick. Canadian glass mills use more cullet (over 50%) than U.S. mills. Domglass uses 80% cullet at their Montreal facility and can process additional green and amber glass. Because of the greater percentages of cullet used at these Canadian plants, the incoming cullet must be of a higher quality. For any shipments to Canadian mills, it will, therefore, be necessary to ensure high quality.

Consumers Glass is another Canadian processing company with plants in Quebec, Ontario, and British Columbia. Each of these mills processes green glass cullet including approximately 50% recycled glass.

Robert Peloquin et Fils, Ltd. is a Canadian broker and intermediate glass processor. Glass is processed at their Montreal plant; an additional 15,000 to 20,000 tons of green glass could be processed at this facility.

Paper recycling, to be most effective, requires separating the newspapers, corrugated, magazines, and other papers from the waste stream. Further separation into newspaper, corrugated, and mixed bales would then be suitable for overseas shipment. It would also be possible to locate an MRF next to a paper mill, thus eliminating the need for sorting and baling. Several paper mills in New England provide potential markets for recycled papers. North Shore Recycled Fibers operates seven paperboard mills in the U.S., with one in Haverhill and one in Natick. They indicated the possibility of handling additional tonnage from MRFs.

Willimantic Waste Paper in Willimantic, Connecticut buys, bales, and sells paper to U.S. and foreign markets. If paper supplies from Massachusetts were sorted and baled, they would be able to ship it to overseas markets.

Sonoco Products Company of Holyoke, Massachusetts produces paper and paper products using recycled material. They buy mixed, loose papers from the public and indicated that they could purchase an additional 20,000 tons per year.

The preliminary report indicates that glass, tin, and paper recycling markets are available and represent potential buyers for Massachusetts's recyclables. It will be necessary, however, for the recyclables to be of high quality, in order to be the most marketable. The following section examines recycling programs in Massachusetts and around the country and shows how recycling is effective today and can be effective tomorrow in the Commonwealth.

4.6.5 Other Recycling Programs

Wellesley

Wellesley, with a population of approximately 27,000, has operated a recycling and disposal facility (R&D) since 1971. Estimates indicate that 15% of Wellesley's solid waste was recycled in FY 1983 and that recycling provided approximately $90,000 in revenues to the town. Wellesley does not provide curbside collection; approximately 75% of the residents take their refuse to the R&D, while the remaining 25% have their refuse removed through contracts with private haulers. Since 1976, the town Department of Public Works has operated the R&D. The facility is open Monday through Saturday from 7 a.m. to 5 p.m. and is staffed by seven employees.

The Wellesley recycling effort began in 1971 when a local, nonprofit organization organized a recycling center near the then-existing incinerator. The organization began an intensive publicity campaign in regard to the center and received help from the other local citizen's groups. By 1976, the Wellesley DPW took over and enlarged the center, and recycling continues to be successful in Wellesley today.

The concept of Wellesley's refuse disposal program is to recycle and reuse as much refuse as possible. The remaining portion is then shipped to a private landfill. Private haulers are charged a tipping fee; however, separated recyclable materials are deposited free of charge. Leaves and grass clippings are composted and the compost is available at no charge to town residents. Public trees removed by the DPW are cut for firewood and left by the roadside for town residents. Limbs and smaller wood pieces are chipped and stored for the residents to use as mulch.

To convey an idea of the extent of Wellesley's recycling, the following items are recycled at the Wellesley R&D:

newspaper, cardboard, paperbags, magazines; clear, green, and brown glass; aluminum, steel, tin, and bi-metal cans; 1- and 2-liter soda bottles; engine, miscellaneous petroleum and vegetable oils; tires; automotive and wet cell batteries; iron, steel, aluminum, brass, and copper; logs, kindling, lumber, Christmas trees; leaves; returnable bottles & cans; books, clothing, small equipment, furniture (available for reuse by residents free of charge).

Oregon

Oregon's recycling program is based on legislation which states that by July 1986, each citizen of Oregon must have the "opportunity to recycle." The opportunities include recycling depots at every disposal facility or at a more convenient location; curbside collection of recyclables at least once per month for communities with populations greater than 4000; and an outreach campaign to help communities with recycling programs.

Oregon defines an item as "recyclable" when the cost of recycling is less than or equal to the cost of collection and disposal. Approximately 99% of all Oregon communities have private trash collection, putting the responsibility of compliance with the law on the haulers. Once a month curbside collection of recyclables has begun in over 85% of Oregon's cities and towns. "Recycling associations" are planning for processing centers and marketing cooperatives. The state of Oregon also has the right to mandate source separation and collection of recyclables where the Act's goals are not being met.

New Jersey

New Jersey's program is based on a 12 cents/cubic yard tipping fee charged to all waste disposed of in New Jersey's landfills, amounting to a $5 million total. Approximately 45% of this revenue can be returned to communities based upon the tonnage they recycle. Approximately 40% of the fund is also returned to communities in the form of education and assistance in developing local recycling programs. The remaining 15% comprises the operating expenses of the State Office of Recycling.

New Jersey communities receive a rebate of approximately $100 for each ton recycled. The New Jersey program has been in effect since 1983, with 320 of the state's 560 communities participating in the rebate program. Of the 320 communities, approximately 100 have locally-mandated source separation and collection programs, accounting for over 75% of the total tons recycled.

4.7 Disposal Options for Special Wastes

There are several other types of waste produced within communities which require special disposal methods. There are so many difficulties inherent in cost-effective and environmentally sound disposal of sludge from wastewater treatment plants, demolition wastes, tires, and tree stumps that each of these wastes could be the subject of a separate study. However, to give an indication of the problems involved, this section contains an overview of each special waste stream.

4.7.1 Sludge

Communities with either primary or secondary wastewater treatment plants generate sludge on a daily basis. There are four general disposal methods for this sludge: incineration, ocean dumping, landfilling, and composting. Use of all these methods is complicated by the possible presence of heavy metals and/or pathogens in the sludge. Incinerators, landfills, and composting facilities are hard to site because they are perceived as noxious by abutters.

Incineration has been used, but requires fossil fuel to burn the sludge. Neighborhood concerns over odors, air emissions, and truck traffic required to transport the sludge to the incinerator may make it impossible to site an incinerator. Designing a pollution control system for the incinerator to meet air quality standards for heavy metals will result in additional costs. Modern resource recovery facilities for municipal solid waste will not accept sludge because of its moisture and possible heavy metal content.

Ocean dumping is frequently a method of last resort for coastal communities; siting costs and potential pollution of groundwater and/or the air have made ocean dumping the method of least resistance. However, the EPA and environmental groups have long opposed this method as simply transferring potential pollution problems. The EPA is gradually eliminating ocean dumping as an alternative.

Landfilling is also used for sludge disposal. However, there is great concern over sludge leaking from unlined landfills and polluting groundwater. In some cases, a chemical additive is used to solidify the sludge before it is placed in the landfill.

Lastly, composting has been used not only as a disposal method, but a means of creating a useful end product. Unfortunately, the compost may be contaminated with heavy metals, making use of it difficult. Siting a composting facility is difficult because of the amount of land required and abutters' concern over odors, rodents, and other noxious side effects.

4.7.2 Demolition Waste

All the left-over lumber, bricks, concrete blocks, roofing material, plumbing, fixtures, and other material remaining after a building is destroyed or demolished must be disposed of. At the present time, nearly all of this material is landfilled because resource recovery plants cannot accept it. Much of the material is bulky, noncombustible, and may contain lead-based paint or asbestos, thereby making it unsuitable for resource recovery.

4.7.3 Tires

Used tires are difficult to dispose of satisfactorily. When landfilled, they do not compact and they work their way back up to the surface, destroying attempts at covering and capping. They cannot be incinerated in quantity because of the resultant air pollution.

Various reuses of tires are possible, such as highway crash barriers and artificial reefs. Shredded tires can be landfilled successfully, used in asphalt for road building and repairing, or even used as bulking agent for composting of sewage sludge. Ultimately, it may be possible to use a pyrolysis or destructive distillation process to produce oil, gas, and a residue from discarded tires. Also a high temperature carbonization process will produce carbon black, an ingredient in synthetic rubber.

There are several other "high-tech" disposal methods under development, as well as attempts to burn shredded tires for fuel both alone or in combination with oil.

4.7.4 Tree Stumps

Many communities are faced with large, sometimes diseased tree stumps requiring disposal. Because of their bulky nature, they are difficult to landfill. However, they do require covering, if diseased. Large chippers are available, but many communities do not have the volume of stumps to justify purchase of a chipper. So, at this time, most stumps are landfilled and communities will continue to need access to a small landfill area for stump disposal.

In the future, chipped stumps will be eligible for resource recovery facilities (whole stumps are too large to burn completely and hinder combustion of other parts of the waste stream). The chips also make an excellent bulking agent for composting sewage sludge.

5. Transporting Solid Waste

The EPA has estimated that refuse collection accounts for 70 to 85% of total solid waste management costs. There are, however, ways to trim this portion of the total waste disposal budget. Options are available to communities which can increase the efficiency of collection or hauling and lower transportation costs.

Curbside collection, hauling to a landfill or resource recovery facility, or installing a transfer station are some of the alternatives a community must consider. The transportation aspect of solid waste management is complex, due to the many variables and combinations available. Transportation issues tend to be town-specific only to a point. This is not to say that regional transportation plans cannot be effective. On the contrary, many communities have discovered that by joining together, a more economical and effective transportation plan can be developed.

In making any solid waste management decisions, citizens should be aware of the advantages and disadvantages that the various options hold. Transportation decisions should also consider present and future disposal sites.

Transportation costs represent a major portion of most communities' waste disposal budgets, regardless of whether transportation is handled by the municipality or by a private entity. Often, local officials are unaware of the fiscal burden involved. Municipal collection costs may be "hidden" in several parts of municipal budgets; private collection service costs often include both transportation and disposal charges in one lump sum. This section of the study will show the significant impact of transportation on overall solid waste disposal and will explain the important variables involved in transporting refuse from the source to the ultimate disposal site (UDS).

Transportation costs demonstrate a history of steady increases. As both municipal and commercial landfills close, haulers must drive greater distances in search of available disposal sites. And, after reaching a disposal site, a hauler often must wait in line, increasing the time and therefore the costs of disposal.

According to recent surveys, by 1990, only 3 commercial landfills in eastern Massachusetts will be accepting refuse as compared with the present figure of approximately 15 locations. Thus, an estimated 3600 tons of refuse per day will have to find alternate disposal sites at greater distances, if such facilities are available at all.

Many MAPC communities have already begun to feel these pressures, while negotiating new disposal contracts. The town of Dedham will be paying in FY86 almost twice the amount paid in 1984 for collection and disposal. Table 1-14 gives several additional examples.

5.1 Transportation Alternatives

There are four basic methods to transport refuse from the source (home) to the ultimate disposal site (UDS):

(1) Curbside collection service hauled directly to the UDS.
(2) Curbside collection service hauled to a transfer station and hauled to the UDS.
(3) Resident hauling directly to the UDS.
(4) Resident hauling to a transfer station and collection service hauling to the UDS.

Within each method, there are additional variables to be considered. Because of the unique situation of individual towns, the alternatives may be combined to meet each town's needs better.

Table 1-14

Solid Waste Disposal Costs 1985-86

Recent Increases in Solid Waste
Disposal Costs In The Boston Area
(Annual Contract Costs For Hauling & Disposal)

COMMUNITY	FY 1985	FY 1986	PERCENT CHANGE
DEDHAM	$ 350,000	$ 695,000	99%
HOLLISTON	290,000	400,000	38%
MILFORD	31,500	57,500	82%
NORWOOD	370,000	600,000	62%
WALPOLE	390,000	460,000	18%
WESTWOOD	350,000	500,000	43%
DUXBURY	215,000	550,000	156%

The average increase for these 7 towns is 71%.

In addition, with any of the four alternatives, there are three basic questions to be answered:

(1) Should collection services be provided?
(2) Should the refuse be hauled directly to the UDS or should an intermediate transfer station be used?
(3) Should the transportation system be municipally or commercially operated?

The answers to these questions cannot be decided independently of one another. A community must, in fact, decide whether collection services and hauling (directly to the UDS or via a transfer station) will be handled by municipal crews or by a private entity. Furthermore, the choice of the UDS may effect the decision-making process. For instance, a community providing no collection services, which is considering contracting with a resource recovery facility, would not be able to allow resident drop-off at the facility. The factors involved in answering the three questions are discussed below.

5.2 Municipal or Private Services

Any services, whether curbside collection, direct haul, or operation of a transfer station, may be municipally or commercially operated; the issues are basically the same. In the past, municipal ownership and operation of disposal services has been the most common practice. Today, a greater number of communities, especially in eastern Massachusetts, are turning the controls over to commercial enterprises.

It should be noted, however, that simply entering into a contract with a commercial hauler, while appearing to solve the town's problem really does so only on a short-term basis. When the commercial landfills close, the difficulty of disposing of the town's waste will still be present. Due to the intensifying landfill shortage, these commercial hauler contracts tend to be short in term and high in relative cost.

At present, 17 communities within the MAPC area are paying commercial haulers to remove their refuse, but many of them (such as Dedham and Westwood), have learned about the high costs of having another party make the trash "disappear." Dedham's annual fee went from $371,000 to $695,000, to help the contractor cover required environmental protection measures in his landfill, as well as higher operating costs. Westwood, with just over 13,000 residents (compared to Dedham's 25,300), pays $500,000 to another commercial hauler.

In eastern Massachusetts, there are nearly 150 haulers in business. A small percentage have obtained waste transport contracts for resource recovery facilities. The remainder face rapidly dwindling landfill space, unless the situation changes dramatically in the future, due to strong public incentive programs.

Municipal operations can be less costly than private ones, due to the nonprofit, tax exempt status of the public operations. Larger municipalities or groups of towns can purchase equipment, fuel, and other supplies in greater quantities, thus saving additional money. Aside from the costs, the municipality has, in theory, tighter control over the collection services and any policies involved. This could enable a community to track the success of the services effectively, while making any necessary changes and carrying out long-range planning. The municipal system also enables any mandatory requirements--such as source separation for recycling--to be instituted effectively in a timely manner.

Unfortunately, however, the local public sector does not often function in this optimum way. Among the drawbacks to public ownership are the tendency toward a lack of efficiency, the disruption of labor disputes, and the responsibility for purchasing and maintaining collection and/or hauling equipment. Often, municipal governments place a low priority on refuse collection services and do not budget sufficient funds to allow for an efficient and well-maintained collection service.

Private services may be used for collection and hauling. The company may enter into a contract with the municipality for town or area-wide collection, or with individual residents for their collection, and/or disposal. Private collecting and hauling services vary in size, from large conglomerates which handle all phases of waste management to small, one-man operations.

Contracts for private collection and hauling services range in time from one year to multiyear agreements. Private services must make a profit, pay taxes, and amortize capital debt, all of which increase costs. However, many private firms are able to provide lower costs than municipal services. Some reasons for this include better management, more efficient use of labor, and revenues generated through recycling.

Private ownership of refuse collection and/or hauling through a public contract relieves the municipality of any operational duties. The municipality does not have to pay the high capital costs necessary for acquiring equipment. Under a competitive-bidding process, prices can be kept down and a community can retain some control over the collection process.

The major disadvantage of private operation is the necessity of regulating the operation by a public agency, in terms of cost and levels of services. If no incentives for improved efficiency are included in the contract, collecting and hauling costs may be unnecessarily high. For private contractual arrangements with individual residents, there is no central control over the service. Collection service companies may agree among themselves to provide service for certain areas, thus eliminating competition and raising costs. As fewer disposal sites are available, more private collectors and haulers are unwilling to enter into contracts longer than one year, so that their cost increases can be passed on more quickly to the consumer. Also, some communities may receive only one bid in response to their advertisement for collection services.

5.3 Feasibility of House-to-House Collection

A second question to be answered about transporting solid waste concerns the collection service. Collection services provide pickup of residents' wastes on a fixed schedule. The alternative to providing collection is to require residents to haul their refuse to a disposal site, which may be a landfill or a transfer station. If a community is being faced with a sudden changes in disposal practices, for example a change in the UDS, it might want to consider the collection options.

Curbside collection provides curbside pickup of trash at the source and direct haul to the UDS. The UDS in this case may be a municipal or commercial landfill or a resource recovery facility. This method of collection is quite common and provides disposal service at an affordable cost if the UDS is in reasonable proximity.

A community has five basic options for curbside collection:

1. Municipally owned and operated collection trucks
2. Municipally owned trucks leased to private firm for operation
3. Municipality operates trucks leased from elsewhere
4. Municipality contracts with a private hauler for collection
5. Any combination of the above.

When a community is about to change its UDS, that is the logical time to evaluate curbside collection practices. If the community has been operating its own trucks, then it would probably continue to do so, since it already has a considerable capital investment in the trucks and a labor force hired to operate them.

A community may decide to institute a curbside collection service and buy the trucks. This purchase represents a high capital cost, but would tend to stabilize future costs. The option of leasing its trucks to a private firm for operation would allow a community to avoid labor and maintenance problems, as well as the high capital costs, but the community could still maintain control over the collection process. Many communities find that the fourth alternative, a commercially owned and operated collection system, is most effective.

Regardless of the method, the main advantage of curbside collection is the assurance and reliability of the proper disposal of refuse. Roadside dumping is for the most part eliminated. Collection of refuse provides more flexibility to a community in terms of its UDS; it allows the use of landfills, transfer stations, or resource recovery facilities.

The major disadvantage of collection is the cost. Collection costs can be quite high, whether commercially or municipally run. For smaller communities and for communities in rural areas, collection costs may be prohibitive.

The alternative to collection is requiring residents to transport their refuse to the disposal site. This method is most often used in smaller, more rural communities where landfills or transfer stations are within the municipal boundaries. Sticker permits may be sold to resident users or a fee based on the amount of refuse delivered may be assessed at the disposal site.

Several MAPC communities rely on residents to transport their waste either directly to the municipal landfill (e.g., Bellingham, Concord, Scituate) or to a transfer station (e.g., Winchester, Wellesley, Medway). The stickers issued to residents, usually for a small fee, are intended to eliminate use of the transfer station or landfill by anyone not a resident of that community. In practice, however, not all communities check permits on a constant basis.

These communities also need an adequate permitting and inspection program for private haulers who collect from residents unable or unwilling to transport their own waste, as well as haulers collecting from businesses and industry within the community.

Besides the avoided cost of curbside collection, a major advantage of having residents transport their own waste is the opportunity it offers for recycling. Many MAPC communities (e.g., Winchester, Wellesley, Bellingham, Hingham) have active recycling programs with excellent participation rates at the transfer station or landfill.

The chief disadvantage of not providing collection service is the possibility of improper dumping. If it is inconvenient for residents to haul waste to the disposal site, the chances for roadside or illegal dumping increase. Traffic congestion can be a problem at the landfill. Moreover, residents without a means of transportation are faced with an added hardship. Without collection, municipalities are limited to landfill disposal (unless the refuse is taken to a transfer station and then hauled to a regional landfill or resource recovery facility).

5.4 Direct Haul Compared to Transfer Station

The third question to be answered concerns the hauling of wastes: is it more economical to haul wastes directly from the source or to use an intermediate transfer station? To answer this question, it is necessary to understand what a transfer station is and how it operates.

A transfer station is a facility to which waste is delivered with smaller vehicles or by individual residents and placed into a larger, more efficient vehicle before being hauled to the UDS. The larger vehicle may and often does include a compactor, allowing greater volumes of refuse to be transported at one time. Transfer stations eliminate the need for multiple trips to the UDS.

Transfer stations lower transportation costs by reducing the number of trips required to the UDS. Collection crews may be reduced, as more time is available for collection (instead of the added hauling time). Transfer stations also reduce the wear and tear on collection vehicles when driving to the UDS. Transfer stations are also useful in communities with no collection services; the residents simply transport refuse to the transfer station. Recycling and other volume reduction methods may easily be added to a transfer stations, further reducing transportation and disposal costs.

Transfer stations tend to be much neater and more easily accepted by residents than landfills. Transfer stations may be managed by municipalities or by private operators.

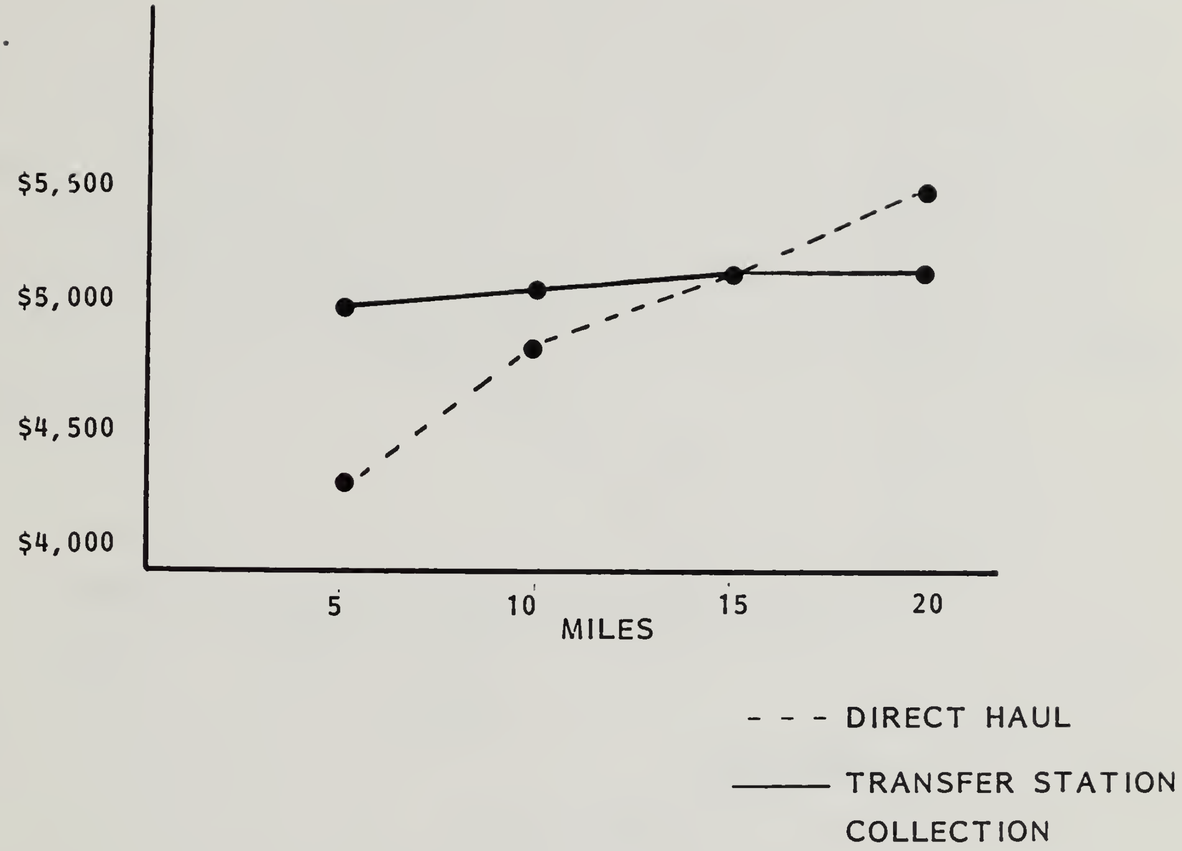
The major disadvantage of transfer stations is the cost. Transfer stations introduce an additional step into the waste handling stream. Additional costs include capital costs for the land, structures, and equipment; labor, utilities, maintenance, and operation costs at the transfer station; and labor, operation, and maintenance costs incurred hauling to the UDS. Siting of transfer stations may also pose a problem.

In determining the feasibility of installing a transfer station, a community must determine if the savings will exceed the costs. Aside from equipment and operational costs, distance to the UDS is a major factor. While there is no set distance at which a transfer station becomes economical, studies have indicated that, if the distance waste must be transported is greater than 15 miles, a transfer station will be less costly (See Figure 1-8). These figures are based on a 100 ton-per-day community with transfer station costs of about $4 per ton. The greater the distance the waste must be hauled to the UDS, the more significant the difference is between direct haul costs and transfer haul costs.

From the private hauler's viewpoint, time spent hauling is the crucial factor affecting cost. According to figures from Browning-Ferris Industries, direct haul becomes more expensive per ton than transfer haul when the round trip driving time increases beyond 1-1/2 hours (See Figure 1-9). If the UDS is less than 1-1/2 hours of driving driving time (round trip) from the end of the collection route, then a community will probably find direct haul to the UDS to be less costly.

It should be noted that other variables have a role in determining the cost-effectiveness of a transfer station, namely, wage rates, type and condition of roads, collection truck and crew size, speed limits, and traffic conditions.

Transfer stations may also provide a cost savings for regional areas. For example, smaller, more rural communities far away from disposal facilities may find that collecting their refuse at one central location prior to hauling reduces transportation costs.



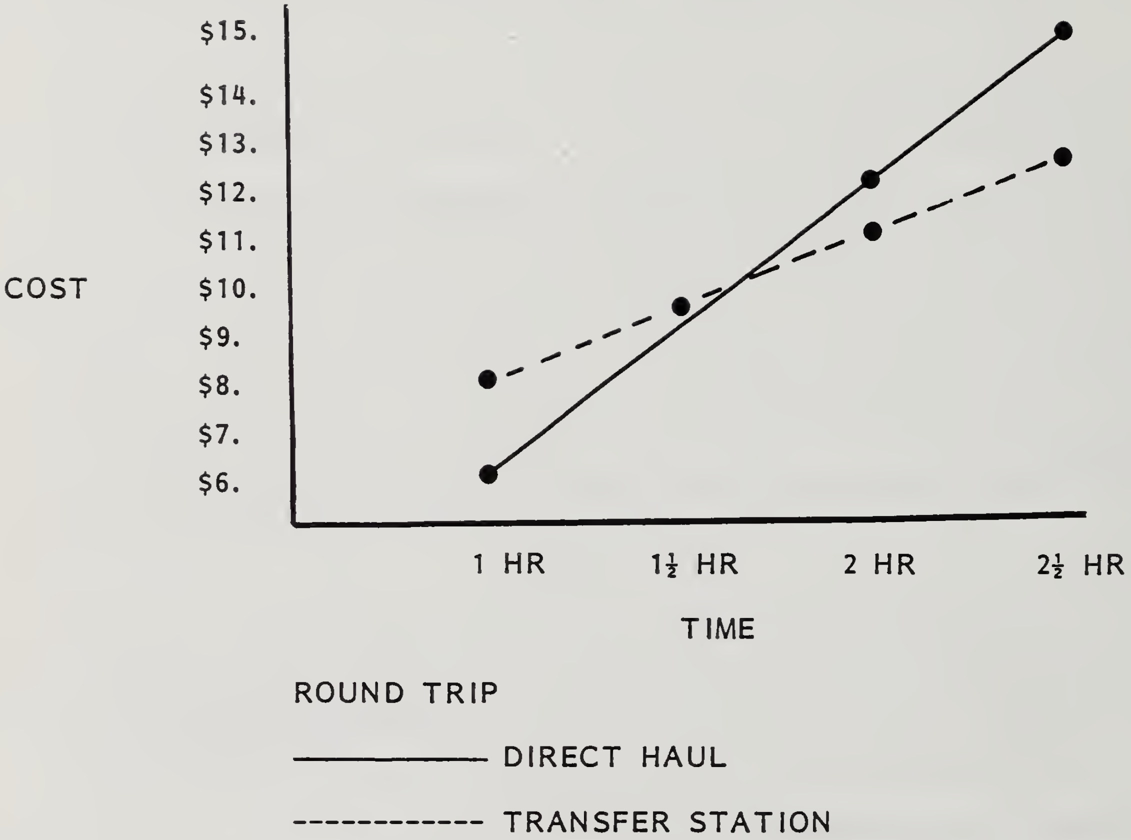
100 TON PER DAY COMMUNITY

TRANSFER STATION COST: $4.00 PER TON

SOURCE: MASS. DEQE

FIGURE 1-8

TRANSFER STATION VS. DIRECT HAUL
COST FEASIBILITY RELATIONSHIPS



SOURCE: BROWNING-FERRIS INDUSTRIES

FIGURE 1-9

TRANSFER STATION (WITHOUT CURBSIDE COLLECTION) VS. DIRECT HAUL COST FEASIBILITY RELATIONSHIPS FROM THE HAULER'S VIEWPOINT

In summary, each community facing major decisions on the choice of transportation method and a UDS must recognize the importance of both transportation and disposal methods. Decisions on one portion of the waste handling process depend on the other. Before communities make major investments in capital equipment, such as trucks and transfer stations, that community must be certain where the waste will be taken for disposal over the next several years. Simply agreeing to let a private hauler collect the waste and also determine the ultimate disposal method is not a long-term solution. At the same time a community is actively deciding how its waste will be collected and transported, it should also be choosing a long-term disposal option.

6. Proposed State Policies

Both the Executive Branch and the State Legislature have begun to address the crisis in solid waste disposal. Brought on primarily by the environmental threat that landfills pose to Massachusetts' groundwater supplies, along with the economic impact of remedial measures, the crisis has promoted development of long-range solid waste management policies.

The Governor of Massachusetts, along with the Secretary of Environmental Affairs, in May of 1985 announced the Solid Waste Plan for the Commonwealth. The plan addresses both the environmental protection aspect of solid waste disposal and overall, long-term waste management issues. It divides responsibility between the state and local communities. In addressing local responsibility, the plan includes certain financial assistance measures to relieve some of the municipal fiscal burdens. The state agency charged with the responsibility of instituting the plan is the Bureau of Solid Waste Disposal (BSWD), now within the Department of Environmental Quality Engineering (DEQE). The BSWD's primary function is to plan, develop policies, and assist communities in choosing long-term waste disposal methods. DEQE will also be responsible for the compliance and enforcement end of the plan.

Many features of the plan were incorporated into House Bill 6258, later redrafted by the Natural Resources and Agriculture Committee. The bill has been refiled during the new legislative session. Copies of the new bill were not available at the time this study went to press. Local decisionmakers will want to be aware that some features of the state plan may become law, if the bill is enacted.

Local officials and citizens are invited to call the MAPC for information as to the status of the bill and its provisions.

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